

- gg. Young growth glabrous.  
 h. Leaves mostly 6 cm. or more wide.  
 i. Leaves broadly elliptic, abruptly short-acuminate, subrugose..... 17. *P. DISTIGMATUM*  
 ii. Leaves ovate, gradually acuminate, not rugose..... 18. *P. DAVIDSONII*  
 hh. Leaves mostly narrower..... 9. *P. PHYTOLACCAE-FOLIUM*

1. *PIPER PESARESANUM* C.DC. in Engl. Bot. Jahrb. 40:247. 1908, as *petaresanum*, obviously an error.

*Piper fluvii-initii* Trel. in Ann. Mo. Bot. Gard. 27:291. 1940.

A shrub or small tree, 3–8 m. tall, nodose; upper internodes rather short, thick, subreflexed-hirtellous with an intermixture of scattered long hairs; leaves elliptic-to round-ovate, 5–11 cm. wide  $\times$  13–17 cm. long, apex sharp-acuminate, base rounded, subinequilaterally obtuse, one side 1–2 mm. shorter, bullate-lacunose, pinnately nerved from the lower half, the nerves about 6 or 8 on each side, rusty-villous above, at least along the nerves, rather densely so beneath, especially along the nerves, with a mixture of long and short hairs, margin ciliate, drying firm, dark, opaque; petiole 10–20 plus 1–2 mm.<sup>2</sup> long, villous, vaginate and narrowly winged toward the base; spikes 8–10 mm. thick  $\times$  9–13 cm. long; peduncle stout, 1–2 cm. long, villous; bracts oblong-subligulate, pilose to near the subacute, curved apex; fruit subcylindrical, glabrate, stigmas 3, elongated, recurved on a moderate or short, somewhat sparsely hispid or glabrate style.

Western Colombia and Panama, commonly at rather high altitudes.

CHIRIQUÍ: trail from Cerro Punta to headwaters of Río Caldera, alt. 2250–2500 m., *Allen 1445*; Bajo Chorro, Boquete District, alt. 2100 m., *Davidson 204*.

This species rather closely resembles *P. lacunosum* of western South America but differs in the type of pubescence, shape of the bracts, and more elongated fruits. The Chiriquí specimens agree in all respects with those seen from South America.

2. *PIPER ALBOPUNCTULATISSIMUM* Trel. in Ann. Mo. Bot. Gard. 27:287. 1940.

A somewhat nodose shrub, 4 m. tall; upper internodes glabrous, sparingly warty-papillate; leaves elliptic, apex acute, base obliquely cordate-auricled, one side about 5 mm. shorter at the petiole, the larger side about equaling the petiole, about 18 cm. wide  $\times$  28–30 cm. long, pinnately nerved from below the upper third, the nerves 6–8 on each side, submarginally loop-connected and with numerous cross-connecting and anastomosing nervules, glabrous above, the nerves beneath puberulent or crisp-pubescent, marginal ciliation lacking, sparsely yellow-glandular-dotted on both sides, microscopically white-dotted above when dry, drying rather firm, subtranslucent; petiole 45 plus 5 mm. long, winged-vaginate to near the blade, sparsely warty; spikes 5 mm. thick  $\times$  25 cm. long; peduncle

<sup>2</sup>The base of the blade in many species of *Piper* is unequal on the two sides with one side somewhat shorter at the petiole. The petiolar length is given plus the difference in length between the two sides.

about 4 cm. long; bracts triangular-subpeltate, ciliate, the pedicel broad, concave; stigmas 3, linear, on a short, stout style.

Known only from the following locality.

COCLÉ: north rim of El Valle de Antón, alt. 600–1000 m., *Allen 1652*.

3. *PIPER DARIENENSE* C.DC. in DC. Prodr. 16<sup>1</sup>:374. 1869.

*Ottonia glaucescens* Miq. in Seem. Bot. Voy. Herald, 200. 1854, not *Piper glaucescens* Jacq.

*Piper dariense* C.DC. in Candollea 1:168. 1923.

*Piper laxispicum* Trel. in Contr. U. S. Nat. Herb. 26:24. 1927.

*Piper laxispicum* var. *latifolium* Trel. loc. cit. 1927.

*Piper Permar* Trel. in Ann. Mo. Bot. Gard. 27:295. 1940.

*Piper fagopyricarpum* Trel. loc. cit. 28:426. 1941.

A glabrous shrub, mostly scarcely 0.5 m. tall; stems simple or occasionally branched, 2–3 mm. thick, somewhat finely striate, greenish; leaves oblong-elliptic, subovate or lance-elliptic, 3–7 or sometimes 8 cm. wide  $\times$  12–19 cm. long, apex attenuately sharp-acuminate, base narrowed, subequilaterally acute or rounded and obtuse, minutely auriculate at the petiole, pinnately nerved throughout, the midrib rather prominent beneath, the lateral nerves slender, 6–9 on each side, divergent and submarginally loop-connected, drying green above, paler and subglaucous beneath, membranous, translucent; petiole mostly scarcely 5 mm. long, longitudinally striate, scarcely vaginate at the very base; spikes 3–5 mm. thick  $\times$  3–5 cm. long when mature; peduncle about 5 mm. long; rachis smooth or obscurely papillate; bracts cupulate, glabrous; fruit mostly exserted, free, globose-tetragonous, smooth or obscurely papillate, stigmas short, 3–4, on a short, stout style.

Panama and northern Colombia.

BOCAS DEL TORO: upper Changuinola River, *Permar s. n.*; vicinity of Chiriquí Lagoon, *von Wedel 1042*. CHIRIQUÍ: vicinity of Puerto Armuelles, alt. 0–75 m., *Woodson & Schery 852*. CANAL ZONE: Barro Colorado Island, Gatún Lake, *Standley 31375*; *Mexia 6551*; *Bailey & Bailey 88*. PANAMÁ: Indio, Madden Lake, *Miller 2065*—leaves maximum size, as described. SAN BLAS: forests around Puerto Obaldía, alt. 0–50 m., *Pittier 4288*.

The type specimen did not have a sufficiently matured spike to show the characters of the fruit, which are significant in this species. The description of the vegetative characters, however, agrees in all respects with the other specimens included here. It was reported by Seemann as being used by the Indians for stupefying fish. *Mexia* made the same report for the specimen she collected on Barro Colorado Island.

4. *PIPER LINCOLNENSE* Trel. in Field Mus. Nat. Hist. Bot. Ser. 18:347. 1937.

A shrub (?); flowering internodes moderately slender and short, obscurely retrorsely hirtellous on one side, the other side papillate glabrescent; leaves broadly elliptic or ovate-elliptic, apex short-acuminate, base slightly inequilaterally cordulate, 7.5–10.5 cm. wide  $\times$  16–20 cm. long, pinnately nerved from below the upper third, the nerves about 6 on each side, rather prominent beneath, glabrous above, glandular-dotted and crisp-pubescent beneath, especially along the nerves, not ciliate, drying dull, papery, translucent; petiole 1.5–2 cm. long, rather densely

reflexed-hirtellous, vaginate to the blade; spikes 3–4 mm. thick  $\times$  6–8 cm. long, peduncle 1.5–2 cm. long, thinly and obscurely hirtellous; bracts triangular, the pedicel broad and concave, glabrous; fruit depressed, slightly flattened laterally with the rachis, stigmas 3, slender, on a short style.

Known only from Lincoln Creek, Bocas del Toro.

BOCAS DEL TORO: Lincoln Creek, Changuinola Valley, *Dunlap 408*.

The broadly elliptic leaves, pubescent beneath, and stylose fruits characterize this species.

5. *PIPER PERVENOSUM* C.DC. in *Candollea* 1:268. 1923, name only; Schroeder, in *Candollea* 3:137. 1926.

A shrub; flowering internodes short, moderately slender, retrorsely hirtellous; leaves ovate, apex gradually acute, base subequilateral, rounded, obtuse or subcordulate, 7–12.5 cm. wide  $\times$  13–18 cm. long, glabrous on both sides or with the nerves beneath obscurely and minutely hirtellous, pinnately nerved from the lower half or slightly above, the nerves 3 or 4 on each side, with shorter intermediates, and minor lateral nerves to near the apex, nervules very numerous and closely spaced as seen by transmitted light, glandular-dotted, the glands comparatively large, drying gray-green, firm, translucent; petiole 5–20 mm. long, stout, vaginate-winged to the blade, retrorsely hirtellous; spikes 3–4 mm. thick  $\times$  3 cm. long; peduncle 5–10 mm. long, hirtellous; bracts triangular-lunulate, papillate; ovary subglobose, stigmas small, on a short style.

Known only from the following locality.

SAN BLAS: San Blas coast, high hills back of Puerto Obaldía, alt. 50–200 m., *Pittier 4302*

The gray-green twigs and ovate, finely venulose leaves are distinctive features of this species.

6. *PIPER PERULIGERUM* Trel. in *Ann. Mo. Bot. Gard.* 27:295. 1940.

Small and suffruticose; twigs, petioles and leaves at first rusty subtomentose-villous; internodes short and rather slender; leaves lance-elliptic, apex long-attenuate, base obliquely cordulate, one side 2–3 mm. longer, 3.5–5 cm. wide  $\times$  11–14 cm. long, pinnately nerved from the lower half, the nerves 3–5 on each side, with strong cross-connecting-anastomosing nervules, becoming slightly pouched between veins, the midrib above moderately pubescent, subvillous beneath, the nerves rather strongly so, the hairs staring and of various lengths, the longest nearly 1 mm. long, drying papery, translucent; petiole scant 3 plus 2–3 mm. long, densely villous; spikes 3 mm. thick  $\times$  2.5 cm. long; peduncle 3 mm. long; stigmas on a short style.

Known only from the following locality.

BOCAS DEL TORO: Isla de Colón, *Woodson, Allen & Seibert 1939*.

The above description is drawn largely from the type description by Trelease inasmuch as the fragment at Illinois consists of two leaves only. Trelease indicated that the type is at the Missouri Botanical Garden but it has not been seen by the writer.

7. *PIPER exiguicaule* Yuncker, sp. nov.

Frutex, 30 cm. altus; foliis obovatis vel elliptico-obovatis, apice subacutis, basi subaequilateralibus, ad petiolum abrupte acutis, a tertio supero deorsum pinnatim venosis, venis utrinque ca. 6, supra dissite villosis, subtus ad venas crispe vel adpresse pubescentibus, sat obscure glanduloso-punctatis; petiolo 2 cm. vel ultra longo; spicis, ut adsunt, 3 mm. crassis, 3.5 cm. longis; pedunculo 2.5 cm. longo; bracteis triangulari-subpeltatis, conferte pallido-fimbriatis; ovario subgloboso, stylo brevi; stigmatibus 3, rotundatis.

Shrub, 30 cm. tall; stem sparsely pubescent (?); leaves obovate or elliptic-obovate, apex acutish, base subequilateral and abruptly acute at the petiole, 7–12 cm. wide  $\times$  12–19 cm. long, pinnately nerved below the upper third, the nerves about 6 on each side, with prominent cross-connecting-anastomosing nervules, sparsely villous above, the nerves beneath crisp- or appressed-pubescent, rather obscurely glandular-dotted, drying papery, translucent, finely pellucid-dotted; petiole up to 2 cm. or more long, vaginate toward the base (?); spikes as yet young, 3 mm. thick  $\times$  3.5 cm. long; peduncle 2.5 cm. long, sparsely pubescent; bracts triangular-subpeltate, densely pale-fringed; ovary subglobose, stigmas 3, rounded, on a rather short, stout style; fruit not developed.

Known only from the one collection.

BOCAS DEL TORO: Fish Creek, Apr. 9, 1941, *von Wedel 2187* (Herb. Missouri Bot. Gard., TYPE).

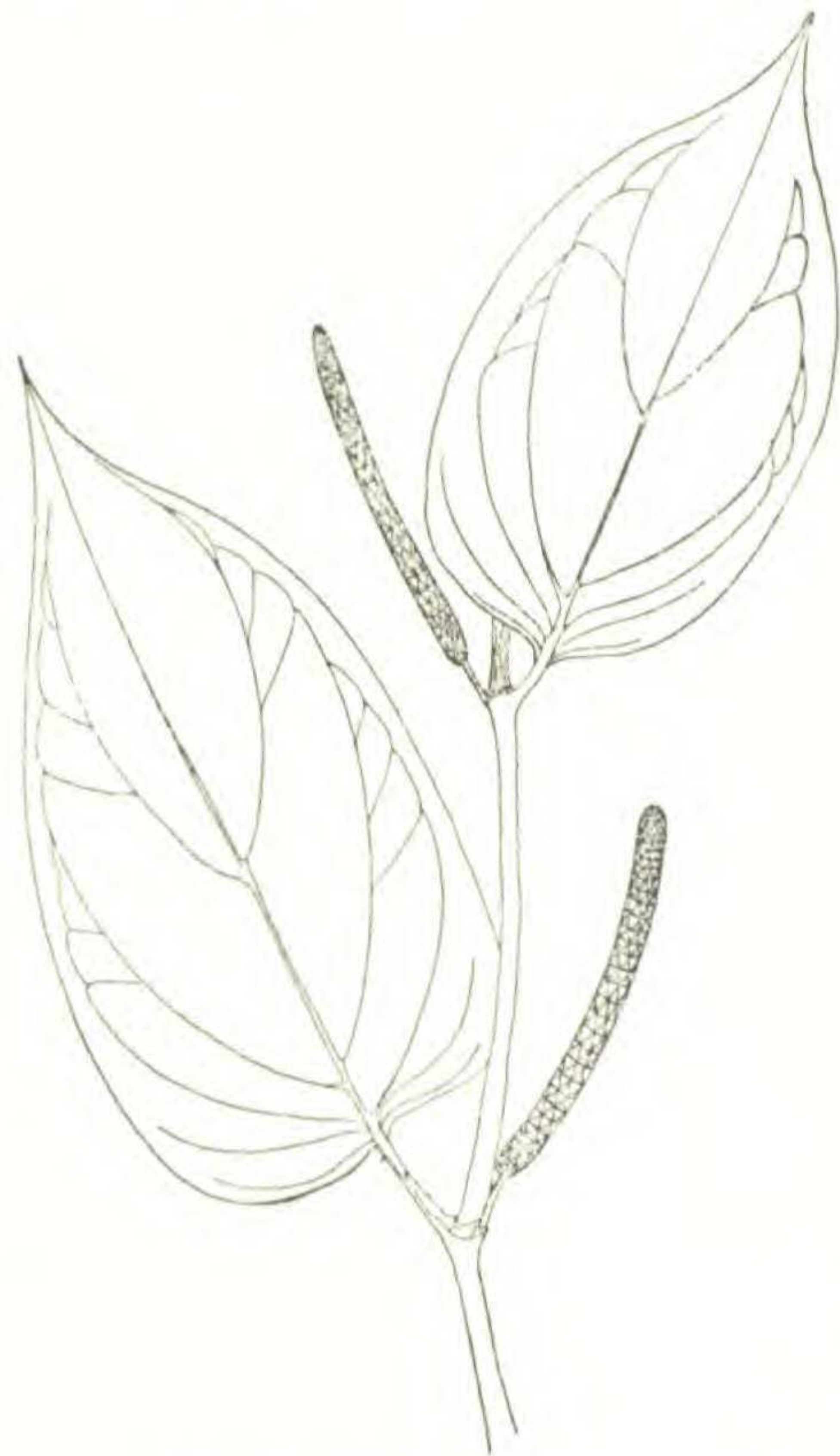


Fig. 1. *Piper crassinervium*  
var. *tocotanum*

The type specimen is rather poor and fragmentary but it does not appear to agree with any other known species. The very small plants, obovate leaves, densely fringed bracts, and stylose ovaries are distinctive characters.

8. *PIPER CRASSINERVIUM* H.B.K. var. *tocotanum* (C.DC.) Yuncker, comb. nov.

*Piper exserrens* (Miq.) C.DC. var. *tocotanum* C.DC. in Ann. Conserv. & Jard. Bot. Genève 21:239. 1920.

*Piper papyraceum* Trel. in Contr. U. S. Nat. Herb. 26:31. 1927.

*Piper novae-helveticae* Trel. in Ann. Mo. Bot. Gard. 27:294. 1940.

An essentially glabrous shrub or small tree, 2–5 m. tall; upper internodes comparatively short but soon lengthening, glabrous; leaves ovate, 5–14 cm. wide  $\times$  13–23 cm. long, apex acuminate, base rounded, obtuse or in large leaves sometimes shallowly cordate, equilateral or with one side slightly shorter, abruptly acute

at the petiole, pinnately nerved from below the middle, the nerves 4 or 5 on each side, prominent beneath, glabrous or at most only sparsely minutely puberulent along the nerves, drying firm, translucent; petiole about 15 mm. long, vaginate and narrowly winged to the middle or above; spikes 5–7 mm. thick  $\times$  12–15 cm. long when mature; peduncle stout, 5–15 mm. long, pubescent; bracts rounded- or triangular-subpeltate, marginally fringed, zonately arranged; fruit rounded, glabrate, stigmas 3, recurved, on a rather short style.

Venezuela, Colombia, and Panama; the species Colombia and Ecuador.

CHIRIQUÍ: vicinity of "New Switzerland," central valley of Río Chiriquí Viejo, alt. 1800–2000 m., *Allen 1359, 1416*; forests around El Boquete, alt. 1000–1300 m., *Pittier 3023*.

No significant difference has been found by means of which the Panamanian specimens can be distinguished from those from South America.

9. *PIPER PHYTOLACCAEFOLIUM* Opiz in Presl, Reliq. Haenk. 151. 1830.

*Piper brevispicatum* Opiz, loc. cit. 151, pl. 28. 1830.

*Artanthe heterophylla* Miq., Syst. Pip. 502. 1844.

*Artanthe brevispicata* Miq., loc. cit. 508. 1844.

*Artanthe phytolaccaefolia* Miq., loc. cit. 534. 1844.

*Peltobryon phytolaccaefolium* Presl, Epim. Bot. 224. 1849.

*Piper singulare* C.DC. in Jour. Bot. 4:161. 1866.

*Piper amphoricarpum* Trel. in Contr. U. S. Nat. Herb. 26:29. 1927.

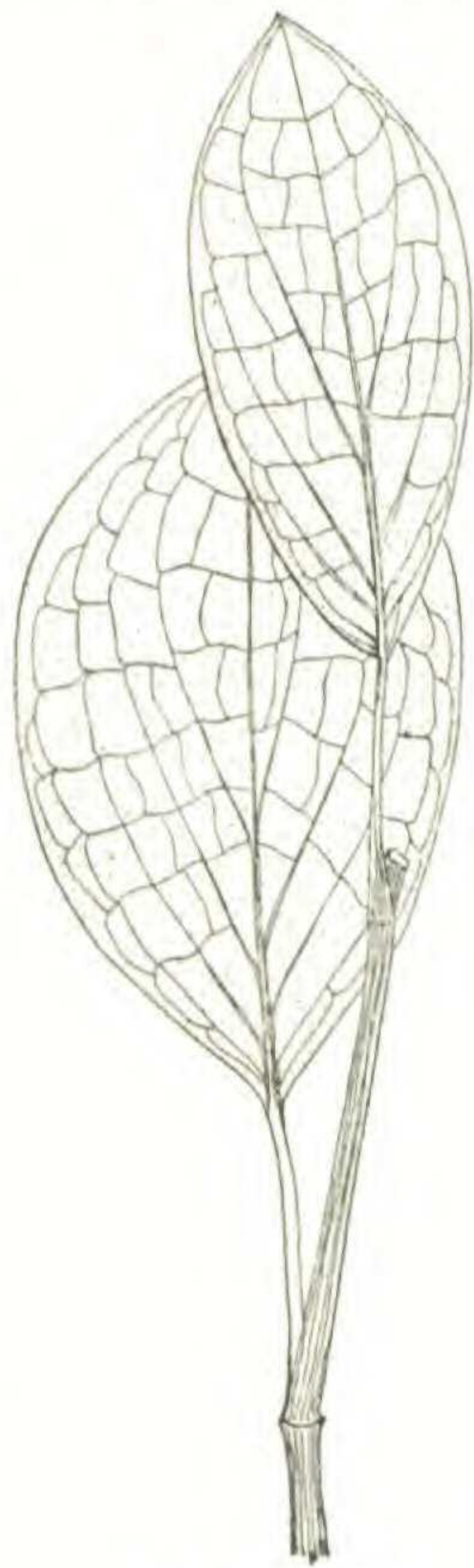
*Piper simulans* Trel. in Field Mus. Nat. Hist. Bot. Ser. 18:361. 1937.

A glandular-granular shrub, 1–2 m. tall, glabrous or obscurely and transiently puberulent; twigs rather slender; leaves lance- or oblong-elliptic, 3–6 cm. wide  $\times$  10–13 cm. long, or occasionally up to 8  $\times$  19 cm., apex acuminate, base acute to cuneate, mostly equilateral, glandular-dotted, often strongly so, pinnately nerved throughout or some leaves from below the upper third, the nerves 4, or in large leaves 5–6 on each side, mostly scarcely ciliate; petiole 5–10 mm. long, vaginate at the base; spikes 5 mm. thick  $\times$  2–4 cm. long; peduncle 5–20 mm. long, glabrate or very sparsely hirtellous; bracts triangular- or rounded-subpeltate, marginally fringed; fruit globose, stigmas 3, small, on a short subulate style.

Colombia, Ecuador, and Panama.

PANAMA: without definite locality, *Née 363, 364, 367*. BOCAS DEL TORO: Changuinola Valley, *Dunlap 459*. CHIRIQUÍ: Boquete District, Boquete, alt. 1140 m., *Davidson 619*; along Río Caldera, south of El Boquete, alt. 1250 m., *Killip 3611*.

No significant differences have been discovered between the Panamanian specimens cited here and those which have been studied from South America. Those from Panama, however, are, so far as seen, less conspicuously glandular-dotted than are those of South America. A specimen collected by Née without definite locality indicated has the leaves ciliate and with a few scattered long hairs on the upper surface.

10. *PIPER macropunctatum* Yuncker, sp. nov.Fig. 2. *Piper macropunctatum*

Frutex, ca. 0.5 m. altus, dissite hirtulus; internodiis usque ad 6 cm. longis, obvie conferte glandulosis; foliis elliptico-obovatis, apice obtusis vel abrupte brevi-acutis, basi inaequaliter acutis, latere altero ca. 2 mm. brevior, utrinque glabratis vel subtus ad basem dissite pubescentibus, a medio laminae deorsum pinnatim venosis, venis utrinque 5, utrinque conferte glanduloso-punctatis, margine revolutis; petiolo 2–4 cm. cum 2 mm. longo; basi vaginato; bracteis triangulari-lunato-subpeltatis; ovario ovoideo glanduloso, stylo brevi, crasso, subalato, stigmatibus parvis.

A small, essentially glabrous shrub, about 0.5 m. tall; stem unbranched, internodes up to 6 cm. long, strongly glandular-dotted; leaves elliptic-obovate, apex obtuse or abruptly short-acute, base inequilaterally acute, one side about 2 mm. shorter, 6–8.5 cm. wide  $\times$  13–15 cm. long, glabrous on both sides or sparsely pubescent near the base beneath, pinnately nerved from the lower half, the nerves 5 on each side, with cross-connecting-anastomosing nervules, submarginally loop-connected, strongly glandular-dotted on both sides, drying rather thin, translucent, pellucid-dotted, revolute; petiole 2–4 cm. plus 2 mm. long, glabrous or sparsely pubescent, vaginate near the base; spikes 3 mm. thick  $\times$  2.5 cm. or more long; bracts triangular-lunate-subpeltate, glabrous (?); ovary glandular, ovoid, with a short, stout, subulate style, stigmas small, sessile.

Known only from the type locality.

BOCAS DEL TORO: Pumpkin River, July 28, 1941, *von Wedel 2561* (Herb. Missouri Bot. Gard., TYPE).

The small, simple, glabrous plants, strongly glandular-dotted with comparatively large dots, obovate, revolute leaves, and pointed ovary distinguish this species. The only spike present on the type specimen is fragmentary and young.

11. *PIPER LATIBRACTEUM* C.DC. in Smiths. Misc. Coll. 71<sup>6</sup>:5. 1920.

A shrub, about 1 m. tall; flowering internodes moderately stout and short, glabrous; leaves broad-elliptic, apex gradually acute, base narrowed, obtuse or slightly cordulate, one side 1–2 mm. shorter, 11–14 cm. wide  $\times$  20–24 cm. long, pinnately nerved below the upper third, the nerves 7–8 on each side, with intermediates and slender cross-connecting and anastomosing nervules, glabrous above, the nerves beneath puberulent, somewhat rugose, glandular-dotted, drying subglossy and green above, paler beneath, papery, translucent; petiole 15–20 plus 1–2 mm. long, vaginate and narrowly winged to the blade; spikes 8 mm. thick  $\times$  2 cm. long, apiculate; peduncle stout, scarcely 10 mm. long; bracts triangular-lunate,

glabrous, or marginally papillate, pedicel broad, concave; ovary glabrous, stigmas 2, recurved, on a short, stout style.

Southern Panama.

DARIÉN: Boca de Pauarandó, Sambú River, alt. 20 m., *Pittier 5588*; Cañi-Cuasi Trail, Chepigana Dist., alt. 900 m., *Terry & Terry 1441*; alt. 1650 m., *Terry & Terry 1581*.

The numerous nerves, puberulent beneath, short, thick, apiculate spikes, and stylose ovaries distinguish this species.

12. *PIPER CANDELARIANUM* C.DC. in *Linnaea* 37:357. 1872.

*Piper globosum* C.DC. loc. cit. 340. 1872 not Poir. 1804.

*Piper psilocladum* C.DC. in *Bull. Soc. Bot. Belg.* 30<sup>1</sup>:211. 1891.

Scandent shrub, glabrous; flowering internodes rather slender and short, red-granular; leaves lance-elliptic or the lower subovate, apex gradually acute, base subequally acute or one side slightly shorter than the other, 2.5–4 cm. wide  $\times$  8–12 cm. long, pinnately nerved throughout, the nerves mostly 6–7 on each side, with rather obscure intermediates and cross-connecting nervules, drying thin but firm, translucent, prominently yellow- or red-glandular-dotted on both sides; petiole scarcely 1 cm. long, vaginate toward the base; spikes 4–8 mm. thick  $\times$  1.5–2.5 cm. long, mucronate; peduncle slender, about 1 cm. long, eventually recurving; bracts triangular-subpeltate, sparingly very short-fringed on the upper margin; fruit rather large, globose, attenuate into a short, stout style, conspicuously glandular roughened, glabrous, stigmas 3.

Costa Rica and adjacent Panama.

BOCAS DEL TORO: Old Bank Island, vicinity of Chiriquí Lagoon, *von Wedel 1994*.

The short, thick styles, short spikes, glandular twigs, and pinnately nerved leaves are distinctive characters of this species. It resembles *P. cumaralense* of Colombia to some extent but differs because of its completely glabrous twigs and leaves and with the nerves of the leaves not submarginally loop-connected as in that species.

13. *PIPER MAGNANTHERUM* C.DC. in *Smiths. Misc. Coll.* 71<sup>6</sup>:16. 1920.

A glabrous, strongly red-glandular shrub (?); flowering internodes short and slender; leaves lance-elliptic-oblong, apex acuminate, base obliquely acute, one side 5–10 mm. shorter, 3.5–5 cm. wide  $\times$  12–15 cm. long, pinnately nerved from the lower half, the nerves 4 or 5 on each side, or with additional lateral nerves to the upper fourth, with few cross-connecting nervules, rather loosely ciliate toward the apex, drying thin, translucent; petiole 5–10 plus 5–10 mm. long, or on lower leaves up to 2 cm., vaginate at the base; spikes as yet young, 2–3 mm. thick  $\times$  1.5 cm. long, mucronate, peduncle 5–8 mm. long; bracts triangular-subpeltate, marginally pale-ciliate; ovary ovoid, narrowing into a short, stout style, stigmas 3, small, short.

Known only from the following locality.

DARIÉN: Cerro de Garagará, Sambú basin, southern Darién, alt. 500–974 m., *Pittier 5666*.

The densely red-glandular leaves, twigs, etc., strongly inequilateral base of the leaves, and stylose ovaries distinguish this species. It resembles *P. phytolaccaefolium* in many respects but differs because of the inequilaterally based leaves, and conspicuous red-glands.

14. *PIPER GARAGARANUM* C.DC. in Smiths. Misc. Coll. 71<sup>6</sup>:15. 1920.

A shrub; flowering internodes moderately slender, rather short, moderately to sparsely loosely villous; leaves lance-elliptic, apex sharp-acuminate, base equilateral and obtusish, or more commonly inequilateral and acute with one side about 2 mm. shorter, 4.5–7 cm. wide  $\times$  13–17 cm. long, pinnately nerved from below the middle, the nerves 3–4 or 5 on each side, with rather open, cross-connecting-anastomosing nervules, loosely long-villous, especially along the nerves beneath, somewhat long-ciliate, glandular-dotted beneath, drying rather thin and papery, translucent; petiole 20 plus 2 mm. long on lower leaves and vaginate-winged to about the middle, reduced upward, villous; spikes 3 mm. thick  $\times$  15–18 mm. long; peduncle about 5 mm. long, villous; bracts small, concave, short-ciliate along the concave margin; ovary ovoid, narrowing into a short, stout style, stigmas rather short, recurved.

Darién Province.

DARIÉN: foothills of Garagará, Sambú basin, alt. 30–500 m., *Pittier 5618*; Chepigana Dist., Caña-Cuasi Trail (Camp 2), alt. 600 m., *Terry & Terry 1432*.

The short spikes, and thinly long-villous and ciliate leaves distinguish this species.

15. *PIPER PUBISTIPULUM* C.DC. in Smiths. Misc. Coll. 71<sup>6</sup>:5. 1920.

*Piper pubistipulum* var. *eustylosum* Trel. in Contr. U. S. Nat. Herb. 26:28. 1927.

A small shrub, 1 m. tall; upper internodes short, densely retrorsely hirsute; leaves oblong-lanceolate, apex gradually rather long-acuminate, base somewhat narrowed, cordulate, one side 2–3 mm. shorter, glabrous above except for the midrib which is pubescent near the base, pubescent beneath with the nerves hirsute, 5–6 cm. wide  $\times$  15–19 cm. long, pinnately nerved from the lower half, the nerves 4 on each side, raised beneath, with cross-connecting and anastomosing nervules, sparsely glandular-dotted beneath, smooth or subrugose, drying firm, translucent; petiole stout, 6–8 plus 2 mm. long, densely hairy, deeply vaginate to the blade; spikes 3–4 mm. thick  $\times$  2 cm. long, mucronate; peduncle 5 mm. long, hirsute; bracts triangular-lunate, glabrous, pedicel broad, cupulate; ovary narrowed abruptly into a short, thick style, stigmas 2, recurved.

Central Panama.

CANAL ZONE: Barro Colorado Island, Gatún Lake, *Standley 31364*; hills around the Agua Clara Reservoir, near Gatún, alt. 20–30 m., *Pittier 2661*. PANAMÁ: Indio, *Miller 2078*.



The densely pubescent stems, oblong-lanceolate leaves, pubescent beneath and with somewhat inequilateral, cordulate bases, short spikes, and stylose fruits distinguish this species. The spike on the type of var. *eustylosum* is so young that it is not possible to determine the style character. The specimen agrees so well otherwise that it is believed that it is same as the species.

16. *PIPER COLON-INSULAE* Trel. in Ann. Mo. Bot. Gard. 27:290. 1940.

A shrub, 2 m. tall; upper internodes relatively slender, densely dingy-villous; leaves elliptic, apex acute or short-acuminate, base inequilaterally cordulate, margins subequal at the petiole, 5–8.5 cm. wide  $\times$  13–16 cm. long, glabrous above or the midrib with a few hairs at the very base, villous beneath, at least along the nerves, pinnately nerved below the upper third, the nerves about 5 on each side, with numerous cross-connecting-anastomosing nervules, drying papery, translucent; petiole 1–1.5 cm. long, densely dingy-villous, vaginate to the blade; spikes 5 mm. thick  $\times$  2.5–3 cm. long; peduncle 8 mm. long, subhirsute; bracts narrowly triangular-lunate, glabrous; fruit subquadrangular-oblong, stigmas on a very short style.

Known only from the following locality.

BOCAS DEL TORO: Isla de Colón, alt. 25–75 m., Woodson, Allen & Seibert 1934.

17. *PIPER distigmatum* Yuncker, sp. nov.

Frutex (?) vel arbuscula glabratus 2–3 m. altus; internodiis floriferis modice brevibus gracilibusque; foliis late ellipticis, apice abrupte breviter acuminatis, basi obtusis vel ad petiolum abrupte subacutis, rugosis, infra medium pinnatim venosis, venis utrinque 5, subtus prominentibus, rubro-glanduloso-punctatis; petiolo 1.5–2.5 cm. longo, ad laminam vaginato; spicis 5–8 mm. crassis, 1.5–2.2 cm. longis apiculatis; pedunculo ca. 1 cm. longo; bracteis triangulari-lunatis glabratis; drupa subglobosa, stigmatibus binis ligulatis recurvis, stylo sat longo crasso subulato fultis.

A glabrous shrub (?) or small tree, 2–3 m. tall; flowering internodes moderately short and slender; leaves broadly elliptic, apex abruptly short-acuminate, base rounded, obtuse or abruptly subacute at the petiole, 8–9.5 cm. wide  $\times$  14–17 cm. long, rugose, pinnately nerved from below the middle, the nerves 5 on each side, prominent beneath, not branched but with slender cross-connecting and anastomosing nervules, red-glandular-dotted, especially on the lower surface, drying firm, translucent; petiole 1.5–2.5

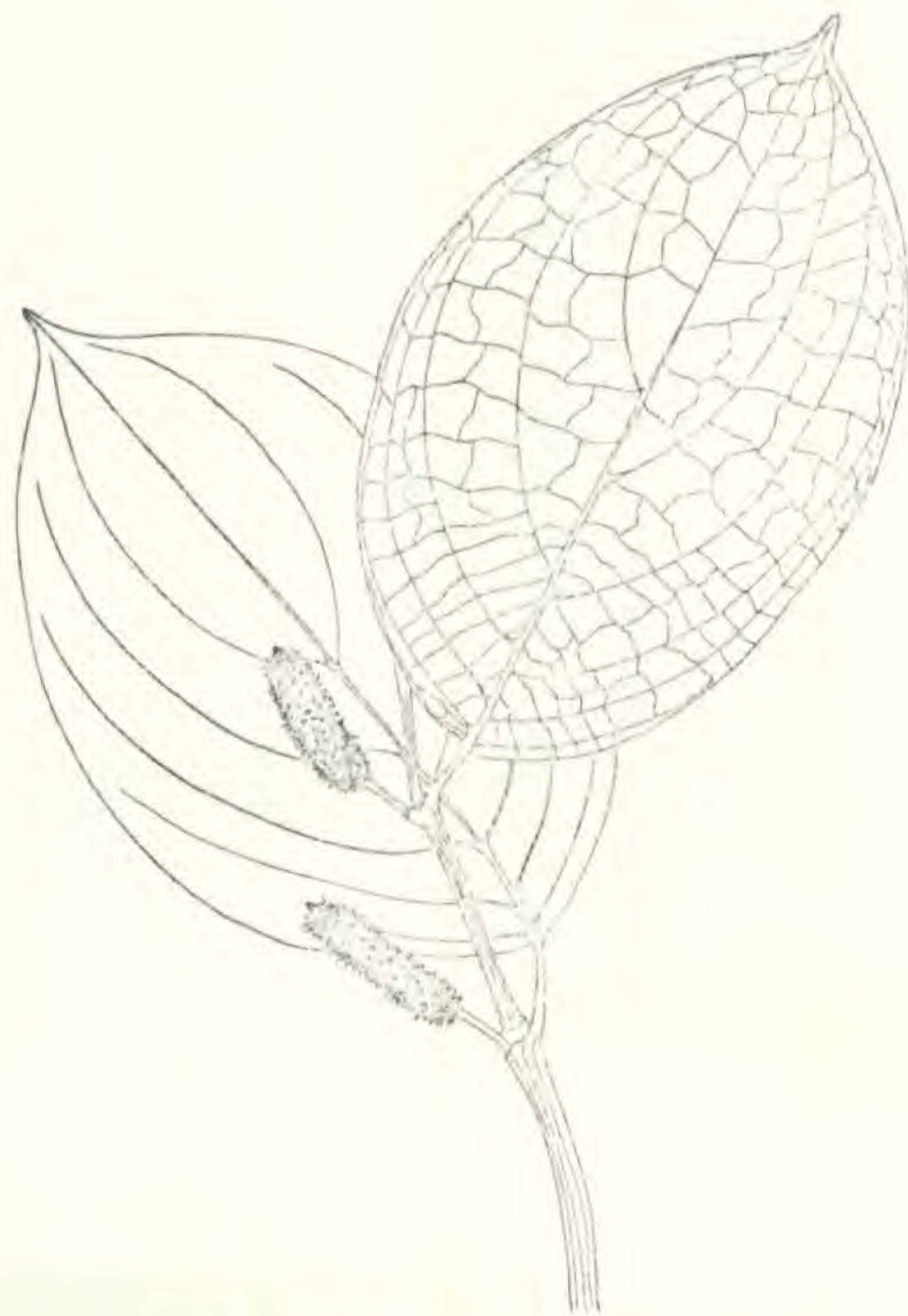


Fig. 3. *Piper distigmatum*

cm. long, vaginate to the blade; spikes 5–8 mm. thick  $\times$  1.5–2.2 cm. long, apiculate; peduncle about 1 cm. long; bracts triangular-lunate, glabrous, pedicel broad, curved; fruit subglobose, stigmas 2, ligulate, recurved, on a rather long, stoutish, subulate style.

Known only from the type locality.

CHIRIQUÍ: Boquete Region, Cerro Horqueta, cloud forest, alt. 1950 m., April 17, 1940, *von Hagen & von Hagen 2009* (Herb. Missouri Bot. Gard., TYPE); April 27, 1940, *von Hagen & von Hagen 2058*.

The broadly elliptic, somewhat rugose leaves, and bistigmatic, rather long-styled fruit distinguish this species. It differs from *P. Davidsonii* because of the shape of the larger, rugose, more abruptly acuminate leaves, 5-nerved on each side.

18. *PIPER Davidsonii* Yuncker, sp. nov.

Frutex parvus glaber; internodiis superis sat brevibus gracilibusque; foliis ovatis vel elliptico-ovatis, apice acuminatis, basi rotundatis ad petiolum abrupte acutis, infra medium pinnatim venosis, venis utrinque 4, manifeste rubro-glanduloso-punctatis; petiolo ca. 1.5 cm. longo, ad laminam vaginato; spicis, ut adsunt, 5 mm. crassis, 1 cm. longis; pedunculo 1 cm. longo; bracteis triangulari-subpeltatis, glabratis; ovario globoso (?), stigmatibus 2, stylo longo fultis.

A small, glabrous shrub, 1–2 m. tall; upper internodes rather short and slender; leaves ovate or elliptic-ovate, apex acuminate, base rounded, abruptly short-acute at the petiole, 6–7.5 cm. wide  $\times$  14–16 cm. long, pinnately nerved from below the middle, the nerves 4 on each side or with a very slender fifth nerve at the base in large leaves, strongly red-glandular-dotted, especially beneath, green above, pale beneath, drying firm, translucent; petiole about 1.5 cm. long, vaginate to the blade; spikes, as represented, 5 mm. thick  $\times$  1 cm. long; peduncle 1 cm. long; bracts triangular-subpeltate, glabrous, the pedicel broad, concave, papillate; ovary globose (?), stigmas 2, on an elongated style.

Known only from the type locality.

CHIRIQUÍ: Bajo Chorro, Boquete District, alt. 1800 m., Feb. 15, 1938, *M. E. Davidson 285* (Herb. Missouri Bot. Gard., TYPE).

II. KEY TO SPECIES WITH PALMATELY NERVED LEAVES

(The nerves may coalesce within the lowermost 5 mm.)

- |   |                                    |
|---|------------------------------------|
| a. Fruit papillate, with a prominent, glabrous, apical disc.....                    | 19. <i>P. RETICULATUM</i>          |
| aa. Fruit lacking any evident apical disc.  |                                    |
| b. Leaf base cordate.   |                                    |
| c. Leaves 9- to 11-nerved.....  | 20. <i>P. MARGINATUM</i>           |
| cc. Leaves 5-nerved.....  | 21. <i>P. ARISTOLOCHIAE-FOLIUM</i> |
| bb. Leaf base rounded or narrowed, scarcely cordate, leaves more or less elliptic.  |                                    |
| c. Leaf base inequilateral with one side about 2 mm. shorter; flowers approximated. |                                    |
| d. Petiole vagina margin glabrous; leaves lanceolate, 3-nerved.....                 | 22. <i>P. HUMORIGAUDENS</i>        |
| dd. Petiole vagina margin ciliate; leaves lance-elliptic, 5-nerved.....             | 23. <i>P. CONVERSUM</i>            |
| cc. Leaf base essentially equilateral, 5- to 7-nerved.                              |                                    |
| d. Flowers distant; bracts glabrous.....  | 24. <i>P. PINOGANENSE</i>          |
| dd. Flowers more compact; bracts papillate-pilose.....                              | 25. <i>P. MEDIUM</i>               |

19. *PIPER RETICULATUM* L. Sp. Pl. 1:29. 1753.*Piper smilacifolium* H.B.K. Nov. Gen. & Sp. 1:56. 1815.*Piper latum* H.B.K. loc. cit. 57. 1815.*Enckea smilacifolia* Kunth, in Linnaea 13:605. 1839.*Enckea lata* Kunth, loc. cit. 606. 1839.*Enckea reticulata* Miq. Syst. Pip. 365. 1843.*Macropiper latum* Presl, Epim. Bot. 223. 1849.*Piper Duchassaingii* C.DC. in DC. Prodr. 16<sup>1</sup>:251. 1869.

A glabrous shrub or small tree up to 4–6 m. tall; branches slender, nodose; leaves elliptic, elliptic-ovate, or broadly ovate, 8–15 cm. wide  $\times$  15–25 cm. long or occasionally up to 25 cm. wide  $\times$  30 cm. long, apex acuminate, base essentially equilateral, more or less acute, truncated, or in large leaves shallowly cordate, palmately 5- to 7-nerved, or larger leaves 9-nerved, the nerves prominent beneath, reticulate-veiny with rather prominent cross-connecting nervules, drying firm and chartaceous; petiole 1–2 cm. long, glabrate or very obscurely puberulent-papillate, grooved above, vaginate near the base; spikes 5–6 mm. thick and up to 10 or 12 or occasionally 15 cm. long when mature; peduncle slender, 1–2 cm. long; rachis with membranous, fimbriated ridges; bracts peltately dilated upward, pedicel and margin bearded; stamens 4; fruit obovoid, somewhat 4-sided, papillate, with an apical, smooth, disc-like area, stigmas 3 or 4, rounded.

West Indies and on the mainland from Central America through northern South America.

BOCAS DEL TORO: Lower Changuinola River, *Stork 50*. CHIRIQUÍ: Progreso, *Cooper & Slater 185*. CANAL ZONE: along Caño Quebrado, *Pittier 6986*; around Gamboa, alt. 40–80 m., *Pittier 3778*; between Gorgona and Gatún, alt. 10–50 m., *Pittier 2279*; near Gatún, *Standley 27201*; Mamei Hill, alt. 20–90 m., *Pittier 3811*; near Summit, *Standley 25728*; Cerro Gordo, near Culebra, *Standley 26008*; Río Pedro Miquel, near East Paraíso, *Standley 29969*; vicinity of Fort Sherman, *Standley 30959*; Barro Colorado Island, *Standley 31267*; *Miller 2075*; Matachin, *Kuntze 1918*; Obispo, *Standley 31726*; vicinity of Gatuncillo, *Piper 5603, 5620*; Río Agua Salud, near Frijoles, *Piper 5859, 5860*; Empire, *Miller 1867*; Madden Dam Road, *Miller 1800*; along Río Chagres between Gamboa and Alahuella, alt. 30–60 m., *Allen 956*. COLÓN: between France Field and Catival, *Standley 30338*; along Río Fató, alt. 10–100 m., *Pittier 3872, 3882*; Fató, *Pittier 3842*. PANAMÁ: Río Tapia, *Standley 26160, 28035, 28241*; near Tapia River, Juan Díaz region, *Maxon & Harvey 6650, 6708*; Juan Díaz, *Standley 30548*; Río Tecumen, *Standley 29363*. DARIÉN: along Sambú River, *Pittier 5570*.

The large, glabrous, rather veiny leaves, comparatively short spikes, and especially the prominent glabrous disc at the top of the papillate fruit, characterize this species. There is a wide variation in the size of the leaves.

20. *PIPER MARGINATUM* Jacq. Icon. Pl. Rar. 2:2, pl. 215. 1786.*Piper decumanum* Aubl. Pl. Guian. Fr. 1:21. 1775, not L. 1760, nor Miller 1763.*Piper caudatum* Vahl, Eclog. Am. 1:3. 1796.*Piper alare* Ham. Prodr. Pl. Ind. Occ. 3. 1825.*Schilleria caudata* Kunth, in Linnaea 13:716. 1839.*Schilleria marginata* Kunth, loc. cit. 718. 1839.*Artanthe caudata* Miq. Syst. Pip. 380. 1843.*Artanthe marginata* Miq. loc. cit. 381. 1843.*Artanthe alaris* Miq. loc. cit. 406. 1843.

*Piper regressum* Anders. in Miq. loc. cit. 380. 1843, as synonym.

*Piper san-joseanum* C.DC. in *Linnaea* 37:351. 1872.

*Piper san-joseanum* var. *chiriquinum* Trel. in *Ann. Mo. Bot. Gard.* 25:826. 1938.

*Piper san-joseanum* var. *kobense* Trel. loc. cit. 27:297. 1940.

*Piper san-joseanum* var. *panamanum* Trel. loc. cit. 1940.

*Piper san-joseanum* var. *tabogense* Trel. loc. cit. 1940.



Fig. 4. *P. marginatum*

A shrub or small tree with moderate to rather short internodes; branches slender, glabrous and blackish when dry; leaves round-ovate, 8–15 cm. wide  $\times$  10–20 cm. long, or rarely some leaves somewhat larger, apex acuminate to long-attenuate-acuminate, base openly cordate or occasionally subtruncate, glabrous on both sides except for slight ciliation and submarginal silkiness, palmately 9- to 11-nerved, nerves entirely free, or the innermost pair of laterals slightly coalescing with the midrib at the base, cross-connecting and anastomosing nervules rather prominent, the leaf margins confluent across the top of the petiole, drying membranous, translucent, pellucid-dotted; petiole up to 4 cm. long or on larger leaves somewhat longer, vaginate-winged to near the blade; spikes 2–4 mm. thick when mature and up to 10–13 cm. or occas-

ionally 20 cm. long; peduncle about 10 mm. long; bracts transversely triangular-peltate, marginally fringed; fruit smooth, obpyramidal, angular; stigmas 3, linear, sessile.

West Indies, on the mainland of Central America, and southward to Brazil and Ecuador.

PANAMA: without indication of locality, *Née* 300, 387. PROVINCE (?): Santa Rita Trail, *Cowell* 117, 122. CHIRIQUÍ: between Río Tabasara and Río Tinta, *Woodson, Seibert & Allen* 416. VERAGUAS: Isla de Uva, Contreras group, *Pittier* 5112. COCLÉ: El Valle, *Miller* 1812. CANAL ZONE: Monkey Hill above Colón, *Lehmann* XLVI; New Limón, *Stevens* 1015; Culebra, *Stevens* 927; Fort Kobe road, *Woodson, Allen & Seibert* 1423; western slope of Ancón Hill, vicinity of Balboa, alt. 20–75 m., *Seibert* 388; Ancón Hill, *Killip* 3041, 12087; *Standley* 26326; Balboa, *Standley* 25600; between Frijoles and Monte Lirio, alt. 30 m., *Killip* 12116; Frijoles, *Standley* 27627; Empire, *Miller* 1862; Juan Mina, *Piper* 5696, 5698; near old Fort Lorenzo, mouth of Río Chagres, *Piper* 5898, 5917, 5962; Culebra, alt. 50–150 m., *Pittier* 2146; Cerro Gordo, near Culebra, alt. 50–290 m., *Pittier* 3737; *Standley* 25964; Corozal, *Stevens* 118; Agua Clara Reservoir, *Stevens* 546; near Summit, *Standley* 25751, 26938; near Gatún, *Standley* 27247, 27288; Gamboa, *Standley* 28334, 28536; near Fort Randolph, *Standley* 28655; vicinity of Fort Sherman, *Standley* 30942; *Stevens* 267; Darién Station, *Standley* 31557; Barro Colorado Island, *Standley* 40832; *Kenoyer* 599. COLÓN: between Fató and Playa de Damas, *Pittier* 3934; vicinity of Santa Isabel, *Pittier* 4176. PANAMÁ: Gorgona Beach, *Woodson, Allen & Seibert* 1690; Taboga

Island, alt. 0-186 m., Woodson, Allen & Seibert 1531; Killip 3165, 3195; Miller 1848; Pittier 3553; Standley 27044, 27057, 27847; Camino de la Granja, Bro. Heriberto 166; Bella Vista, Killip 12012; Standley 25332; Madden Lake, Miller 2077; near Punta Paitilla, Standley 26274; near big swamp, east of Río Tecumen, Standley 26599; along Corozal road, near Panamá, Standley 26834; Río Tapia, Standley 28207; between Fort Clayton and Corozal, Standley 29214; Río Tecumen, Standley 29482; Juan Díaz, Standley 30521; between Las Sabanas and Matías Hernández, Standley 31835. HERRERA: Pesé, alt. 50 m., Allen 801. DARIÉN: around Garachiné, Pittier 5512.

KEY TO THE VARIETIES OF *P. MARGINATUM*

- a. Sinus wide, open, lobes more or less divergent.
  - b. Leaves not pilose above, the nerves glabrous or puberulent.
    - c. Nerves scarcely puberulent..... 20. *P. MARGINATUM*
    - cc. Nerves puberulent, at least above..... 20a. var. *ANISATUM*
  - bb. Leaves appressed-pilose above, at least toward the apex; nerves beneath pubescent..... 20b. var. *CATALPAEFOLIUM*
- aa. Sinus closed or nearly so, lobes approximated or overlapping..... 20c. var. *CLAUSUM*

20a. *PIPER MARGINATUM* var. *ANISATUM* (H.B.K.) C.DC. in Urb. Symb. Ant. 3:172. 1902.

*Piper anisatum* H.B.K. Nov. Gen. & Sp. 1:58. 1815.

*Piper san-joseanum* var. *remediosense* Trel. in Ann. Mo. Bot. Gard. 27:297. 1940.

The nerves puberulent or hirtellous, at least on the upper surface.

Occurs with the species.

CHIRIQUÍ: Río Chiriquí to Remedios, alt. 15-50 m., Woodson, Allen & Seibert 1191. PANAMÁ: Perlas Archipelago, San José Island, Johnston 319, 472; Saboga Island, Miller 1953; along Chararé River, near Chepo, alt. 50-100 m., Pittier 4708. DARIÉN: trail between Pinogana and Yavisa, alt. 15 m., Allen 260.

20b. *PIPER MARGINATUM* var. *CATALPAEFOLIUM* (H.B.K.) C.DC. in DC. Prodr. 16<sup>1</sup>:246. 1869.

*Piper catalpaefolium* H.B.K. Nov. Gen. & Sp. 1:58. 1815.

*Schilleria catalpaefolia* Kunth, in Linnaea 13:718. 1839.

*Artanthe catalpaefolia* Miq. Versl. en Medel. Kon. Nederl. Inst. 1842:197. 1843.

*Piper pseudomarginatum* C.DC. in Bull. Herb. Boiss. 6:492. 1898.

Leaves appressed-pilose above, at least toward the apex, and pubescent along the nerves beneath.

Occurs with the species.

CANAL ZONE: Corozal, Stevens 63. PANAMÁ: Perlas Archipelago, Trapeche Island, Miller 1907. DARIÉN: vicinity of Boca de Cupe, alt. 40 m., Allen 869.

20c. *PIPER MARGINATUM* var. *clausum* Yuncker, var. nov.

Foliis suborbicularibus, basi profunde cordatis, sinu angustato, lobis approximatis vel invicem obtegentibus.

Leaves suborbicular, base deeply cordate with narrow sinus, the lobes approximated or overlapping.

Central Panama.

CANAL ZONE: Empire, March 5, 1937, Miller 1861 (U. S. Nat. Herb., TYPE); vicinity of Salamanca Hydrographic Station, Río Pequení, alt. 80 m., July 28-29, 1938, Woodson, Allen & Seibert 1608—this specimen shows somewhat more open sinuses than does the type.

21. *PIPER aristolochiaefolium* (Trel.) Yuncker, comb. nov.

*Piper san-joseanum* var. *aristolochiaefolium* Trel. in Contr. U. S. Nat. Herb. 26:22. 1927.

A shrub, 1.5–2 m. tall, twigs somewhat zig-zag, granular-papillate, moderately slender; leaves bullate and dark green when growing, rather narrowly ovate, apex long-acuminate, base deeply cordate, sinus open, obtuse, with parallel margins, 8–9 cm. wide  $\times$  15 cm. long, palmately 5-nerved, the innermost laterals not continuing to the apex, the midrib strongly branched upward, the nerves and cross-connecting-anastomosing nervules prominent beneath, the innermost pair of laterals entirely free from the midrib, with scattered, soft, white hairs above, paler and with the nerves granulate-papillate or subhirtellous beneath, ciliate, the hairs restricted to a single marginal row, pale-yellow-glandular-dotted beneath, drying thin, translucent; petiole 3–4 cm. long, vaginate to about the middle, scarcely winged, granulate-subhirtellous. No inflorescence present.

Known only from the type locality.

CANAL ZONE: wet forest, hills north of Frijoles, "scarce," Dec. 19, 1923, Standley 27524 (U. S. Nat. Herb., TYPE).

The specimen on which this species is based is sterile but the vegetative characters are believed to be sufficiently different from *P. marginatum* to warrant specific rank. It differs from that species chiefly because of the 5-nerved leaves, the midrib strongly branched upward, the lateral nerves not continuing to the apex, the ciliation restricted to a single row of marginal hairs, and the shape of the basal sinus.

22. *PIPER HUMORIGAUDENS* Trel. in Ann. Mo. Bot. Gard. 27:293. 1940.

A branching, nodose, glabrous shrub, 2 m. tall; upper internodes short and slender, finely ribbed; leaves lanceolate, apex rather gradually blunt-acuminate, base inequilaterally narrowed downward, one side about 2 mm. shorter at the petiole, the shorter side acute, the longer side rounded, subacute, 2.5–3 cm. wide  $\times$  8–11 cm. long, 3-nerved, the nerves unevenly coalescing within the lowermost 5 mm., salient beneath, cross-connecting and anastomosing nervules very slender, drying rather firm, subtranslucent; petiole scarcely 5 plus 2 mm. long, vaginate near the base; spikes 3 mm. thick  $\times$  4–5 cm. long; peduncle 1–1.5 cm. long; rachis ridges fimbriate; bracts small, subcucullate, marginally short-fringed; fruit somewhat granular, depressed-subglobose, laterally compressed; stigmas sessile.

Known only from the following locality.

COCLÉ: wet north rim, El Valle, alt. 80–100 m., May 21, 1939, Allen 1833.

23. *PIPER CONVERSUM* Trel. in Ann. Mo. Bot. Gard. 27:290. 1940.

Subarborescent, 2 m. tall; young branches nodose, very slender, internodes short, finely striate, obscurely and minutely hirtellous glabrescent; leaves lance-elliptic, apex caudately acuminate, base about 2 mm. shorter on one side, acute, 3–4.5 cm. wide  $\times$  10–12 cm. long, palmately 5-nerved with the outermost pair of nerves delicate and loop-connected with cross-connecting nerves upward, the innermost

pair of lateral nerves slightly coalescent with the midrib at the base, prominent beneath, drying thin, translucent; petiole about 3 mm. plus 2 mm. long, obscurely hirtellous, vaginate toward the base, the margin of the vagina ciliate; spikes as yet young, 2 mm. wide  $\times$  2.5 cm. long; peduncle 5 mm. long, glabrous; bracts inflexed-subpeltate, ciliate; ovary ovoid, stigmas apical.

Known only from the following collection.

CHIRIQUÍ: Llanos del Volcán, alt. about 1300 m., *Allen 1550*.

This species closely resembles *P. humorigaudens* but differs because of the shape of the 5-nerved, more attenuately acuminate leaves, subhirtellous twigs and petioles, and ciliate margins of the petiole vaginal groove.

24. *PIPER PINOGANENSE* Trel. in *Contr. U. S. Nat. Herb.* 26:22. 1927.

*Piper tabasaranum* Trel. in *Ann. Mo. Bot. Gard.* 25:827. 1938.

*Piper salamancanum* Trel. loc. cit. 27:296. 1940.

A shrub or small tree, 1.5–4 m. tall, nodose; internodes slender, rather short, minutely and transiently puberulent, finely ribbed; leaves elliptic, apex caudately blunt-acuminate, base rounded but subacute at the petiole, or narrowed and acute, 3–5.5 cm. wide  $\times$  8–12 cm. long, palmately 5-nerved, the nerves salient on both sides, the innermost pair of laterals coalescing with the midrib within the lowermost 5 mm., with numerous, fine, cross-connecting and anastomosing nervules, drying light green, firm, chartaceous, glossy, translucent; petiole scarcely 5 mm. long, granular-puberulent, channelled above, drying wrinkled, vaginate toward the base; spikes 3–4.5 cm. long, loosely flowered; peduncle scarcely 1 cm. long, obscurely puberulent; bracts very small, concave, glabrous; fruit ovoid, smooth or papillate; stigmas 3 or 4, sessile.

Panama.

CHIRIQUÍ: banks of lower Río Tabasará, *Woodson, Allen & Seibert 440*. CANAL ZONE: vicinity of Salamanca Hydrographic Station, Río Pequení, alt. 80 m., *Woodson, Allen & Seibert 1590*. DARIÉN: around Pinogana, *Pittier 6656*.

25. *PIPER MEDIUM* Jacq. *Icon. Pl. Rar.* 1:2. 1781.

*Piper plantagineum* Lam. *Illustr. Encyc. Meth.* 1:80. 1791.

*Piper saururoides* Ham. *Prodr. Pl. Ind. Occ.* 3. 1825.

*Piper reticulatum* Vell. *Fl. Flum.* 1: pl. 61. 1827, not L. 1753.

*Piper syringaefolium* Balbis ex Kunth, in *Linnaea* 13:599. 1839.

*Piper orthostachyum* Kunth, loc. cit. 602. 1839.

*Enckea plantaginea* Kunth, loc. cit. 599. 1839.

*Enckea orthostachya* Kunth, loc. cit. 601. 1839.

*Enckea Sieberi* Miq. *Syst. Pip.* 358. 1843.

*Piper victorianum* C.DC. in *Jour. Bot.* 4:218. 1866.

*Piper tigerianum* C.DC. loc. cit. 300. 1866.

*Piper Sieberi* C.DC. in *DC. Prodr.* 16<sup>1</sup>:248. 1869.

A shrub; stems and branches glabrous or slightly puberulent when young; leaves lance- to round-elliptic or subrhombically obovate, 3.5–6 cm. wide  $\times$  8–11 cm. long, or rarely occasional leaves up to 10  $\times$  14 cm., apex acuminate, base sometimes suboblique, acute or somewhat rounded, more or less subauriculate at

the very base, or lowermost somewhat cordate, glabrous or puberulent along the nerves beneath, palmately 5- to 7-nerved, reticulate-nervulose, drying membranous and minutely pellucid-dotted; petiole 5-10 mm. long, vaginate near the base, puberulent; spikes 4-5 mm. thick  $\times$  6-7 cm. long; peduncle 10-15 mm. long, puberulent or glabrous; rachis puberulent; bracts obovate-concave, somewhat papillate-pilose; fruit ovoid, minutely papillate or glabrous; stigmas 3 or 4, rounded, sessile.

West Indies, Central and South America.

CANAL ZONE: forest along banks of Quebrada Fea, Q. Pura and Cañon of Río Chagres, alt. 70-100 m., *Dodge & Hunter 17404*. CHIRIQUÍ: Cerro Galera Chorchá, vicinity of Gualaca, alt. 300 m., *Allen 5060*.

This species closely resembles *P. pinoganense* but differs primarily because of its more membranous leaves and hairy rachis and floral bracts.

### III. KEY TO SPECIES WITH LEAVES MOSTLY 20 CM. OR MORE LONG AND MORE OR LESS LOBED AT THE BASE

(The base may be only slightly lobed but none are rounded or acute; the petiole mostly vaginate-winged to the middle or above.)

- a. Leaves rugose or bullate.
- b. Leaves scabrid..... 41. *P. PERACUMINATUM*
- bb. Leaves not scabrid.
- c. Leaves loosely long-villous; peduncle 1-2 cm. long..... 26. *P. PARTITICUSPE*
- cc. Leaves hirtellous to pubescent; peduncle 1-2.5 cm. or more long.... 27. *P. COOPERI*
- aa. Leaves scarcely rugose or bullate.
- b. Leaves and stems glabrous..... 28. *P. HASTULARUM*
- bb. Leaves and/or stems pubescent.
- c. Leaves scabrous..... 41. *P. PERACUMINATUM*
- cc. Leaves not scabrous.
- d. Leaf margin densely ciliolate, drying thin; spikes scarcely 5 mm. thick, yellow when dry..... 29. *P. AURITUM*
- dd. Leaf margin glabrous or essentially so.
- e. Young twigs, nodes and/or petioles and midrib beneath more or less fleshy-warty..... 30. *P. IMPERIALE*
- ee. Not fleshy-warty.
- f. Stems matted brown-hairy, leaves 5- to 7-nerved.
- g. Leaves acute, basal sinus wide, essentially glabrous above.... 31. *P. TARDENS*
- gg. Leaves acuminate; basal sinus narrow, nerves pubescent above..... 32. *P. CAMPANUM*
- ff. Stems glabrous; leaves mostly 7- to 9-nerved.
- g. Leaves glabrous above; petiole vaginate below the middle; bracts glabrate..... 33. *P. CARRILLOANUM*
- gg. Leaves more or less hairy above; petiole vaginate to the blade; bracts fringed..... 34. *P. PITTIERI*

26. *PIPER PARTITICUSPE* Trel. in Ann. Mo. Bot. Gard. 27:294. 1940.

Suffruticose, 3 m. tall; internodes comparatively slender and elongate, for a time crisp-villous; leaves round-ovate, apex falcately acuminate, base inequilaterally cordate with one side surpassing the petiole, sinus open, 15-28 cm. wide  $\times$  20-35 cm. long, pinnately nerved from the lower half, the nerves 6-8 on each side, with prominent cross-connecting and anastomosing nervules, venose-bullulate with 2-4



points to each cusp, the cusp points and the midrib near the base above long-villous, the nerves beneath loosely long-villous, drying firm, translucent; petiole 3–4 cm. long, densely villous; spikes 5 mm. thick  $\times$  15 cm. long; peduncle 1–2 cm. long, loosely villous; bracts triangular-subpeltate, slightly ciliate; fruit small, sub-trigonal, glabrous; stigmas small, sessile.

Known only from the one locality.

COCLÉ: vicinity of El Valle, alt. 600–1000 m., *Allen 1195*.

The villous, round-ovate leaves with multipointed, villous, bullulate elevations characterize this species.

27. *PIPER Cooperi* Yuncker, sp. nov.

Frutex vel arbuscula, 5 m. altus; internodiis floriferis sat crassiusculis elongatis-que conferte crispe-pubescentibus; foliis elliptico-subovatis rugosis, apice breviter subacuminatis, basi oblique cordatis, latere longiore petiolum excedente, infra medium pinnatim venosis, venis utrinque 6–7, laminae facie supra hirtella infra pubescente (ad venas quam maxime); petiolo 4–5 cm. longo, ad medium vel ultra vaginato-alato, conferte crispe pubescente; spicis immaturis 3 mm. crassis, 6 cm. longis; pedunculo 2.5–4 cm. longo, pubescente; bracteis rotundato-subpeltatis, atro-pubescentibus.

A shrub or small tree, 5 m. tall; stem 8 cm. thick, with clustered basal shoots; flowering internodes moderately stout and elongated, matted-crisp-pubescent; leaves elliptic-subovate, apex shortly subacuminate, base obliquely cordate, the longer lobe surpassing the petiole, 15–20 cm. wide  $\times$  16–30 cm. long, pinnately nerved from the lower half, the nerves 6 or 7 on each side, with cross-connecting and anastomosing nervules, hirtellous above, at least along the nerves, pubescent beneath, the nerves densely so, bullate, drying dark, firm, opaque; petiole 4–5 cm. long, vaginate-winged to the middle or above, densely crisp-pubescent; spikes as yet young, 3 mm. thick  $\times$  6 cm. long; peduncle 2.5–4 cm. long, pubescent; bracts round-subpeltate, dingy-hairy.

Known only from the type locality.

BOCAS DEL TORO: vicinity of Almirante, Daytonia Farm, Jan.–Mar. 1928, *G. Proctor Cooper 374* (U. S. Nat. Herb., TYPE).

This species differs from *P. partiticuspe*, which it resembles somewhat, because of the character of the pubescence, longer peduncles, pubescent bracts, etc.

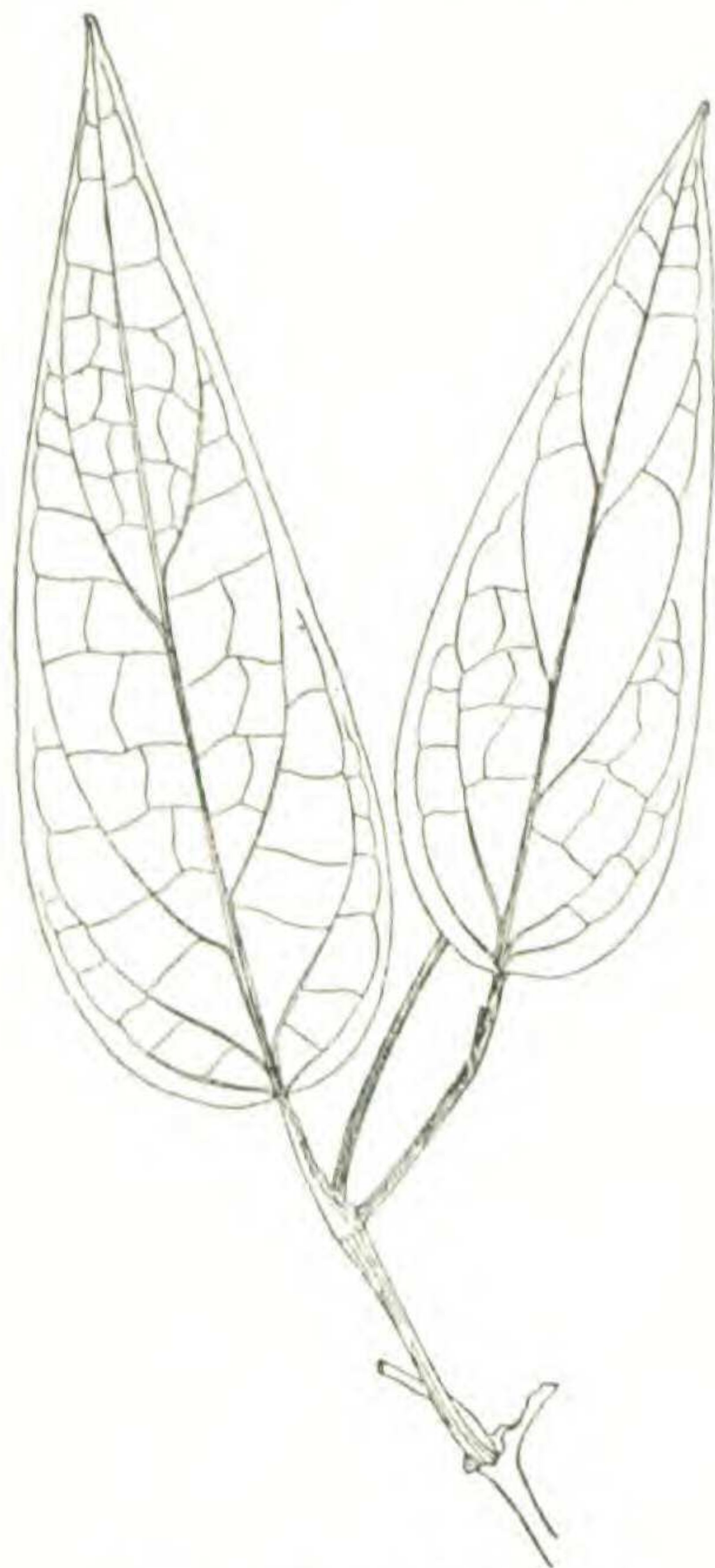
28. *PIPER hastularum* Yuncker, sp. nov.

Frutex primo intuitu glaber, ligno molli, 1–3 m. altus; internodiis floriferis elongatis crassiusculisque; foliis lanceolato-ovatis vel late lanceolatis, 6–11 cm. latis, 22–29 cm. longis, apice sensim acutis acuminatisve, basi oblique inaequilateralibus, ad petiolum utrinque obtusis vel latere altero obtuso acutove ad petiolum 3–10 mm. brevioribus, caetero rotundato-obtusis subcordatisve, a tertio supero pinnatim venosis, venis utrinque 4–5, venulisque submarginalibus gracilibus puberulis, subtus prominentibus trabibus anastomosantibus manifestis, arctius revolutis,

PROCTOR 1195

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Fig. 5. *Piper hastularum*

opacis; petiolo 20–25 cum 3–10 mm. longo, ad laminam vaginato-alato; spicis 3–4 mm. crassis, 13 cm. longis apiculatis; pedunculo 10–20 mm. longo, gracili; bracteis triangulari-sublunatis margine tantum papillatis; drupa laevi, subglobosa, truncata; stigmatibus 3, linearibus, sessilibus.

An essentially glabrous, soft-wooded shrub, 1–3 m. tall; flowering internodes moderately slender to stoutish; leaves lance-ovate or broadly lanceolate, apex gradually sharp-acute to acuminate, base obliquely inequilateral, one side 3–10 mm. shorter at the petiole, both sides obtuse at the petiole or the shorter side subacute, the longer sometimes subcordate, 6–11 cm. wide  $\times$  22–29 cm. long, pinnately nerved below the upper third, the nerves 4–5 on each side, somewhat raised beneath, with rather strong cross-connecting nervules, the submarginal nervule more or less papillate or puberulent, drying chartaceous-subcoriaceous, opaque, somewhat glossy, narrowly revolute, glandular-dotted and sometimes microscopically black-mottled

beneath; petiole 20–25 plus 3–10 mm. long, strongly vaginate-winged to the blade; spikes 3–4 mm. thick  $\times$  13 cm. long; peduncle slender, about 1–2 cm. long; bracts narrowly triangular- or lunate-subpeltate, smooth or papillate, the pedicel broad, concave, glabrous or ciliate; fruit truncate-subglobose, glabrous; stigmas sessile.

Western Colombia and Panama.

COLOMBIA: CHOCÓ: Bahía Solano, dense forest along Quebrada Jellita, alt. 50–100 m., Feb. 22, 1939, Killip & Garcia 33568 (U. S. Nat. Herb., TYPE).

PANAMÁ: BOCAS DEL TORO: Old Bank Island, von Wedel 1934. COCLÉ: El Valle de Antón, along Río Indio Trail, alt. 500–700 m., Hunter & Allen 316. DARIÉN: Chepigana District, Caña-Cuasi Trail (Camp 2), alt. 1200 m., March 10, 1940, Terry & Terry 1461.

The lanceolate leaves and submarginal puberulent nervules distinguish this species.

29. PIPER AURITUM H.B.K. Nov. Gen. & Sp. 1:54. 1815.

*Schilleria aurita* Kunth, in *Linnaea* 13:713. 1839.

*Artanthe aurita* Miq. Syst. Pip. 400. 1844.

*Artanthe Seemanniana* Miq. in Seem. Bot. Voy. Herald, 199, pl. 39. 1854, not *Piper Seemannianum* C.DC.

*Piper auritum* var. *amplifolium* C.DC. in DC. Prod. 16<sup>1</sup>:321. 1869.

*Piper auritum* var. *Seemannianum* (Miq.) Trel. in Contr. U. S. Nat. Herb. 26:40. 1927.

*Piper heraldi* Trel. in Ann. Mo. Bot. Gard. 27:292. 1940.

*Piper heraldi* var. *amplius* Trel. loc. cit. 1940.

*Piper heraldi* var. *cocleanum* Trel. loc. cit. 1940.

*Piper Alstoni* Trel. loc. cit. 286. 1940.

A small, soft-wooded, commonly more or less aromatic tree, 3–6 m. tall, often occurring in clumps; flowering internodes moderately slender and long, striate, often drying black, glabrate or sometimes slightly pubescent; leaves ovate, oblong- or elliptic-ovate, 12–20 cm. wide  $\times$  20–30 cm. long, or occasionally up to 25  $\times$  40 cm. or more, apex acute or short-acuminate, base deeply cordate with one side 1–2 cm. longer at the petiole and with the lower lobe longer, sinus rounded to the petiole, the midrib with 3 or 4 upcurved branches from below the upper third and 3 or 4 branches from the base, rather thinly short-hairy above at least along the nerves, more densely so beneath, densely white-ciliolate throughout, drying thin, translucent; petiole 4–9 plus 1–2 cm. long, more or less pubescent or glabrate, vaginate-winged to the blade; spikes creamy or light-yellow when dry, 3–5 mm. thick  $\times$  10–25 cm. long; peduncle slender, 2–8 cm. long, glabrate, often black when dry; bracts round- or triangular-subpeltate, marginally fringed; fruit small, glabrate, obpyramidal-trigonal; stigmas 3, sessile.

West Indies and on the mainland from Mexico through Central America and northern South America.

BOCAS DEL TORO: Changuinola Valley, *Dunlap 403*; Laguna de Chiriquí, *Hart 126*; vicinity of Nievécita, alt. 0–50 m., *Woodson, Allen & Seibert 1813*; vicinity of Chiriquí Lagoon, *von Wedel 1194*. CHIRIQUÍ: Finca Lérica to Boquete, alt. 1300–1700 m., *Woodson, Allen & Seibert 1095*; Cerro de la Plata, near San Felix, alt. 120–150 m., *Pittier 5159*; vicinity of David, alt. 30–80 m., *Pittier 2829*. COCLÉ: Penonomé, *Williams 434*; north rim of El Valle, *Alston & Allen 1842*; vicinity of El Valle, alt. 600–1000 m., *Allen 1192*. CANAL ZONE: Barro Colorado Island, *Bailey & Bailey 27*; *Bangham 590*; Monkey Hill, *Lehmann 1004*; *Cowell 22*; between Chagres Batteries and Fort San Lorenzo, Fort Sherman Military Reservation, *Maxon & Valentine 6983*; Río Agua Salud, near Frijoles, *Piper 5844*; between Gorgona and Gatún, alt. 10–50 m., *Pittier 2263*; Gatún, *Standley 27244*; *Stevens 833*; *Riley 108*; Fort Sherman, *Standley 30934*; *Stevens 263*; headwaters of the Río Chinilla, above Nuevo Limón, *Maxon 6898*; forests of northerly arm of Quebrada Salamanca as far as falls, alt. 70 m., *Steyermark & Allen 17140*. COLÓN: "Aspinwall," *Hayes 835*; around Porto Bello, alt. 5–100 m., *Pittier 2441*; beach between Fató and Playa de Damas, *Pittier 3933*; along Río Fató, alt. 10–100 m., *Pittier 3909*; vicinity of Santa Isabel, *Pittier 4177*; Puerto Obaldía, San Blas coast, alt. 0–50 m., *Pittier 4380*. PANAMÁ: Manzanillo Island, *Hayes 40, 706*; Chararé River, near Chepo, alt. 100–200 m., *Pittier 4709*; vicinity of Arenoso, lower Río Trinidad, alt. 26–50 m., *Seibert 623*. DARIÉN: Boca de Cupe, *Williams 785*; headwaters Río Chico, alt. 150–225 m., *Allen 4603*.

The thin, deeply and inequilaterally cordate leaves more or less pubescent on both sides and densely ciliolate, long, blackening peduncles, and comparatively small, yellowish spikes distinguish this species.

30. PIPER IMPERIALE (Miq.) C.DC. in DC. Prodr. 16<sup>1</sup>:339. 1869.

*Artanthe imperialis* Miq. in Seem. Bot. Voy. Herald, 198. 1854.

*Piper portobellense* C.DC. Smiths. Misc. Coll. 71<sup>6</sup>:6. 1920.

*Piper affectans* Trel. in Ann. Mo. Bot. Gard. 27:287. 1940.

*Piper frijolesanum* Trel. var. *grandifolium* Trel. loc. cit. 291. 1940.

*Piper gigas* Trel. loc. cit. 292. 1940.

A shrub or small tree, commonly 2–5 m. tall; flowering internodes rather elongate and stoutish, commonly somewhat fleshy-warty especially near the nodes,

pubescent or glabrescent; leaves broadly ovate, apex acute or short-acuminate, base somewhat obliquely cordulate with a rather narrow sinus, both sides essentially equal at the petiole or one side a few mm. shorter, up to 29 cm. wide  $\times$  50 cm. long but usually somewhat smaller, pinnately nerved below the upper third or fourth, the nerves 7-8 on each side, the lowermost 3 or 4 approximated near the base, with cross-connecting and anastomosing nervules, submarginally loop-connected, glabrous above, pubescent beneath, at least the nerves puberulent, the midrib beneath with warty excrescences at least near the base, drying firm, brown, opaque; petiole 6-8 or 12 cm. long, puberulent, vaginate-winged nearly to the blade, with warty-excrescences; spikes 8-10 mm. thick  $\times$  30-50 cm. or more long; peduncle 4-6 cm. or more long, sparsely hairy glabrescent; bracts rounded- or triangular-subpeltate, inflexed, yellow-puberulent or glabrate; fruit rather large, obovoid, glabrous, stigmas linear, on a short, stout, deciduous style.

Panama.

CHIRIQUÍ: vicinity of Casita Alta, Volcán de Chiriquí, alt. 1500-2000 m., *Woodson, Allen & Seibert 846, 865*; Boquete District, Bajo Chorro, alt. 1800 m., *Davidson 374*. COCLÉ: vicinity of El Valle, alt. 600-1000 m., *Allen 1193*. CANAL ZONE: between Frijoles and Monte Lirio, alt. 30 m., *Killip 12155*; hills north of Frijoles, *Standley 27441*; Barro Colorado Island, *Standley 31273, 41115*. COLÓN: forests around Porto Bello, alt. 5-200 m., *Maxon 5795*. PANAMÁ: Taboga Island, *Née 350*. DARIÉN: Chepigana Distr., Caña-Cuasi Trail, alt. 600 m., *Terry & Terry 1500*.

The types of *P. affectans* and *P. frijolesanum* var. *grandifolium* are less warty and the stems are more glabrous than with the other specimens cited, while the young growth of the type of *P. gigas* is somewhat more densely pubescent. The type specimens of both *P. affectans* and *P. gigas* are stated as being trees and with a trunk 30 cm. in diameter. No other differences have been noted in the herbarium specimens, and it is believed that they all represent variations of the same species. So far as discovered, *P. frijolesanum* is a *nomen nudum* as used for var. *grandifolium*.

31. PIPER TARDENS Trel. in Ann. Mo. Bot. Gard. 27:298. 1940.

A shrub or small tree, 1-5 m. tall; flowering internodes rather slender and elongated, densely brown-tomentose-pubescent; leaves pentagonally ovate, apex acute, base inequilaterally oblique, rather shallowly and openly cordate, 10-16 cm. wide  $\times$  17-28 cm. long, pinnately nerved from the lower half, the nerves 5-6 on each side, salient beneath, with rather prominent cross-connecting and anastomosing nervules, glabrous above or the midrib sparsely pubescent near the base, hirsute beneath, the nerves densely so, drying coriaceous, opaque; petiole 3-5 cm. long, vaginate-winged to the blade, densely tomentose-pubescent; spikes 5-8 mm. thick  $\times$  25 cm. long; peduncle 2.5-4 cm. long, densely hairy; bracts rounded- or triangular-subpeltate; pedicel brown-villous; fruit globose, stigmas sessile or on a short style (?).

Chiriquí, Panama.

CHIRIQUÍ: vicinity of Casita Alta, Volcán de Chiriquí, alt. 1500-2000 m., *Woodson, Allen & Seibert 848*; Boquete Distr., Bajo Chorro, alt. 1800 m., *Davidson 78, 373*.

The densely matted twigs, pentagonally-ovate leaves, glabrous above and hirsute beneath, are characteristic of this species. From the material at hand it has not been possible to determine with certainty regarding the presence of a style. Most of the fruit examined do not exhibit any but in a few there appeared to be a short, thick style. This condition, however, may have resulted from the manner in which the fruit dried and may not represent a true style.

32. *PIPER campanum* Yuncker, sp. nov.

Frutex 2 m. altus, internodiis superis gracilibus elongatis, conferte brunneo-pubescentibus; foliis lanceolato-ovatis, apice sat attenuatim acuminatis, basi cordato-auriculatis, latere altero 5 mm. brevior, sinu obliquo, a tertio superno deorsum pinnatim venosis, venis utrinque 6-7, utrinque ad venas pubescentibus, glanduloso-punctatis; petiolo 2.5-4.5 cm. cum 2-5 mm. longo, conferte brunneo-pubescente, ad laminam vaginato-alato; spicis immaturis, 1 mm. crassis, 5 cm. longis; pedunculo gracili, conferte pubescente.

A shrub, 2 m. tall; upper internodes slender and elongate, densely brown-matted-hairy; leaves lance-ovate, apex somewhat attenuately acuminate, base cordate-auriculate, one side up to 5 mm. shorter at the petiole, the sinus lateral, 11-12 cm. wide  $\times$  26 cm. long, or upper leaves smaller, pinnately nerved below the upper third, the nerves 6-7 on each side, branched upward to some extent, with cross-connecting and anastomosing nervules, the nerves pubescent on both sides or only toward the base on the upper surface, drying rather thin, subtranslucent, glandular-dotted; petiole 2.5-4.5 plus 2-5 mm. long, densely brown-hairy, vaginate-winged to the blade; spikes as yet very young, 1 mm. thick  $\times$  5 cm. long; peduncle slender, 1 cm. long, densely hairy; bracts subpeltate, bristly.

Known only from the type locality.

PANAMÁ: Cerro Campana, vicinity of Campana, alt. 1000 m., April 21, 1941, *Allen 2411* (U. S. Nat. Herb., TYPE).

This species resembles *P. tardens* to some extent but differs because of the more acuminate leaf apex, cordate-auriculate base, and more pubescent nerves above.

33. *PIPER CARRILLOANUM* C.DC. in Bull. Soc. Roy. Bot. Belg. 30<sup>1</sup>:209. 1891.

*Piper vallicolum* C.DC. loc. cit. 222. 1891.

*Piper paulownifolium* C.DC. in Anal. Inst. Fis. Geogr. Costa Rica 9:173. 1898.

*Piper tiliaefolium* Cham. & Schlechtd. var. *paulownifolium* C.DC. in Candollea 1:154. 1923.

*Piper Omega* Trel. in Contr. U. S. Nat. Herb. 26:146. 1929.

A shrub, 2-4 m. tall, glabrous except the puberulous nerves on the lower surface; upper internodes moderately slender and elongated; leaves subequilaterally ovate, apex rather long-acuminate, base subtruncate to moderately deeply cordate with open sinus, the blade margin commonly meeting over the petiole, rather small and elongate, 6-8 cm. wide  $\times$  15 cm. long or becoming more rounded and as much as 25  $\times$  35 cm., pinnately nerved to about the middle, 7-9 nerves on each side, the lowermost 3-5 from near the base, salient beneath, with prominent cross-connecting and anastomosing nervules, very finely nervulose by transmitted light,

drying light green, papery, translucent; petiole slender, 2-5 or even 10 cm. long, vaginate winged below the middle; spikes about 3 mm. thick  $\times$  15-25 cm. long; peduncle 1-2 cm. long; bracts small, triangular-subpeltate, glabrate; fruit small, obpyramidal-trigonous, gray-papillate, stigmas small, sessile.

Costa Rica and Panama.

CHIRIQUÍ: Cerro de la Plata, near San Felix, alt. 120-150 m., *Pittier 5158*; Paso de Quebrada Gata, between Hato Jobo and San Felix, *Pittier 5427*. CANAL ZONE: hills north of Frijoles, *Standley 27612*; hills west of the canal, near Gatún, *Standley 27226*; Mamei Hill, alt. 20-90 m., *Pittier 3812*; along Caño Quebrado, *Pittier 6666*; Barro Colorado Island, *Miller 2073*; *Maxon, Harvey & Valentine 6809*; *Standley 31282, 31293, 40870, 40964*; *Bailey & Bailey 30*; *Stevens 645*; Pearson Trail, alt. 100 m., *Wetmore & Abbe 123*; between Gorgona and Gatún, alt. 10-50 m., *Pittier 2261*. COLÓN: Fató (Nombre de Dios), *Pittier 3844*. DARIÉN: Boca de Pauarandó, on Sambú River, alt. 20 m., *Pittier 5687*; Chepigana Distr., Caña-Cuasi Trail, alt. 600 m., *Terry & Terry 1475*.

This species closely resembles *P. casimirianum* Hemsl. of Nicaragua from which it appears to differ because of the leaf shape and puberulence, as described. It is also quite similar to *P. zacuapanum* of Mexico and may, indeed, be the same. The great variation in the size of the leaves often on the same specimen, leaf shape, puberulent nerves beneath, etc. are distinguishing characteristics.

34. PIPER PITTIERI C.DC. in Bull. Soc. Bot. Belg. 29<sup>2</sup>:69. 1890; 30<sup>1</sup>:204. 1891.

A soft shrub, 1 m. or more tall; flowering internodes rather thick and elongated, glabrous, glandular-dotted; leaves broadly ovate, apex abruptly acute or short-acuminate, base truncately shallow-cordate, 14-16 cm. wide  $\times$  15-22 cm. long, pinnately nerved from below the upper third, the nerves about 8 on each side, gradually approximated downward, submarginally loop-connected, with rather prominent cross-connecting-anastomosing nervules, thinly pubescent above, the nerves beneath rather densely villous laterally, ciliate, strongly glandular-dotted on both sides, drying rather thin but firm, translucent; petiole about 6 cm. long, vaginate-winged to the blade, glabrous, glandular-dotted; spikes 5 mm. thick  $\times$  15 cm. long or in fruit up to 12 mm. thick  $\times$  18 cm. long; peduncle stout, 1.5-2.5 cm. long, puberulent glabrescent, glandular-dotted; bracts triangular-subpeltate, narrowly fringed; fruit angularly oblong, with pointed, substylose apex, stigmas 3.

Costa Rica and adjacent Panama.

BOCAS DEL TORO: Robalo Trail, northern slopes of Cerro Horqueta, alt. 1800-2100 m., *Allen 5012*.

The large, somewhat pubescent leaves, rather large spikes, and substylose fruits are distinctive characters of this species.

IV. KEY TO SPECIES PINNATELY NERVED FROM SOMEWHAT BELOW THE MIDDLE TO THE UPPER THIRD OF THE BLADE AND WITH THE LEAVES MOSTLY LESS THAN 20 CM. LONG; IF LONGER, THE BASE IS NOT LOBED.

- a. Leaves scabrous.
- b. Twigs glabrous.
  - c. Leaves glabrous on both sides, scabrous beneath, smooth above..... 35. *P. DAVIDANUM*
  - cc. Leaves hairy beneath, at least along the nerves.
  - d. Leaves mostly 3-4.5 cm. wide, strongly granular-dotted beneath.. 36. *P. MINUTE-SCABIOSUM*

- dd. Leaves 5-6 cm. wide, scarcely granular-dotted beneath..... 52. *P. STORKII*
- bb. Twigs more or less hairy, at least when young.
- c. Spikes strongly and regularly curved; peduncle longer than the petiole..... 37. *P. ADUNCUM*
- cc. Spikes not strongly or regularly curved.
- d. Stem hairs stiff-hispid, comparatively short; leaves harshly scabrous; fruit papillate-puberulent at apex..... 38. *P. HISPIDUM*
- dd. Stem hairs retrorse; leaves finely scabrous.
- e. Plant scandent; leaf base obtuse or acutish..... 39. *P. VITABUNDUM*
- ee. Plant shrubby; leaf base rounded, cordulate..... 78a. *P. WEDELII* var. *RETROHIRSUTUM*
- ddd. Stem more softly pubescent or villous.
- e. Hairs on the midrib beneath erect or at least not upcurved-strigose.
- f. Hairs on midrib beneath mostly up to 1 mm. or more long.
- g. Leaves mostly 18-20 cm. or more long.
- h. Leaves 6-8 cm. wide, very slenderly acuminate, base obtuse or cordulate..... 40. *P. PERSUBULATUM*
- hh. Leaves mostly 10 cm. or more wide, not slenderly acuminate, base rounded-cordate..... 41. *P. PERACUMINATUM*
- gg. Leaves scarcely up to 15 cm. long.
- h. Leaves broadly elliptic, less than two times longer than wide..... 73. *P. CATIVALENSE*
- hh. Leaves 2-3 times longer than wide.
- i. Leaves rhomboid-elliptic, strongly inequilateral; bracts glabrous..... 42. *P. ERUBESCENTI-SPICUM*
- ii. Leaves lance-elliptic, elliptic, or elliptic-obovate.
- j. Petioles scarcely 5 mm. long; stem hairs scarcely 1 mm. long; blades slightly scabrous..... 72. *P. PSEUDO-GARAGARANUM*
- jj. Petioles up to 2 cm. long downward.
- k. Blades mostly 5-8 cm. wide, scarcely scabrous above..... 43. *P. CULEBRANUM*
- kk. Blades 3-4.5 cm. wide, harshly scabrous above.. 44. *P. VIRIDICAULE*
- ff. Hairs on midrib mostly scarcely 0.5 mm. long, dense.
- g. Leaves less than 5 cm. wide; veins above impressed in age.. 45. *P. PERVELUTINUM*
- gg. Leaves 6-8 cm. wide; veins not impressed..... 46. *P. VARIITRICHUM*
- ee. Hairs on the midrib beneath strongly upcurved and appressed or strigose.
- f. Leaves less than 4 cm. wide..... 47. *P. CHANGUINOLANUM*
- ff. Leaves mostly wider.
- g. Blades moderately to densely hairy on the upper surface.
- h. Peduncle scarcely 5 mm. long; blades villous above and harshly scabrous; bracts of young spikes not conspicuously bristly..... 48. *P. VILLIRAMULUM*
- hh. Peduncle 5-10 mm. or more long; blades crisp-hirtellous or subhispid above, slightly scabrous; young spikes very short, conspicuously bristly from erect marginal hairs.
- i. Leaves mostly narrowed downward, usually only the longer side rounded at the base..... 49. *P. TABOGANUM*
- ii. Leaves rounded-cordulate on both sides..... 50. *P. PSEUDO-CATIVALENSE*
- gg. Blades sparsely hairy or glabrous, hairy mostly only along the nerves above.
- h. Young spikes not conspicuously bristly because of the erect bract hairs.
- i. Bracts prominently densely yellow-fringed..... 70. *P. LEPTOCLADUM*
- ii. Bracts very narrowly and sparsely fringed.
- j. Nerves beneath spreading-hirsute..... 51. *P. LUCIGAUDENS*
- jj. Nerves beneath obscurely strigose..... 52. *P. STORKII*
- iii. Bracts glabrous, with a dorsal callus..... 78. *P. WEDELII*
- hh. Young spikes about 1 cm. long, conspicuously bristly because of erect bract hairs..... 49. *P. TABOGANUM*

- aa. Leaves not noticeably scabrous.
- b. Spikes short, scarcely exceeding 2 cm. in length.
- c. Stems and leaves glabrous.
- d. Spikes less than 1 cm. long; bracts glabrous..... 53. *P. WAGNERI*
- dd. Spikes about 2-3 cm. long; bracts densely ciliate..... 54. *P. DUNLAPI*
- cc. Stems and/or leaves hairy.
- d. Stems glabrous or sparsely pubescent; nerves beneath appressed-puberulent..... 55. *P. PALMASANUM*
- dd. Stems rather densely hairy, at least when young..... 16. *P. COLON-INSULAE*
- bb. Spikes longer, mostly 3-5 cm. or more long (or unknown).
- c. Stems and leaves essentially glabrous (nerves hirtellous or puberulous in *P. carrilloanum* and *P. aequale* var. *laurifolium*).
- d. Peduncle 4-7 cm. long..... 56. *P. REPTABUNDUM*
- dd. Peduncle scarcely 2 cm. long at most.
- e. Leaves ovate.
- f. Base mostly acute at the petiole; petiole 1-2.5 cm. long..... 57. *P. CHIRIQUINUM*
- ff. Base obtuse to cordate.
- g. Leaves 10-14 cm. long; petiole 5 mm. long..... 65. *P. TECUMENSE*
- gg. Leaves 15 cm. or more long; petiole 1-2 cm. or more long.
- h. Nerves beneath puberulous; peduncle 1-2 cm. long..... 33. *P. CARRILLOANUM*
- hh. Nerves beneath glabrous; peduncle 0.5-1 cm. long..... 93. *P. GRANDE*
- ee. Leaves elliptic, lance-elliptic, subobovate or obovate.
- f. Leaves mostly 2.5-4.5 cm. wide (rarely wider); apex sharp-to strongly mucronate-acuminate.
- g. Leaves scarcely more than 2-2½ times longer than wide.
- h. Base acutely decurrent, apex strongly mucronate..... 58. *P. TENUIMUCRONATUM*
- hh. Base rounded, obtuse..... 59. *P. SEPTUPLINERVIUM*
- gg. Leaves mostly 3-4 times longer than wide, or base not decurrent.
- h. Bracts smooth; leaves not glandular.
- i. Leaf base rounded, obtuse; nerves 4-5 on each side.... 59. *P. SEPTUPLINERVIUM*
- ii. Leaf base narrowed, acute to cuneate; nerves 3-4 on each side..... 60. *P. SUBQUINQUENERVE*
- hh. Bracts conspicuously yellow-fringed; leaves more or less glandular-dotted.
- i. Leaves drying dull, yellow..... 61. *P. INFRALUTEUM*
- ii. Leaves drying glossy, green..... 80b. *P. HIRTELLIPETIOLUM* var. *HARVEYANUM*
- ff. Leaves larger, mostly 5 cm. or more wide.
- g. Leaves nerved from about the lower third, sharply abruptly acuminate..... 62. *P. CRICAMOLENSE*
- gg. Leaves nerved to about or above the middle.
- h. Leaves mostly 4- to 5-nerved on each side of the midrib (or sometimes 6 in *P. aequale*).
- i. Leaves obovate, revolute, apex mostly obtuse..... 10. *P. MACROPUNCTATUM*
- ii. Leaves oblong-elliptic-subobovate, apex abruptly blunt-acuminate..... 63. *P. AEQUALE*
- iii. Leaves elliptic, apex gradually acuminate.
- j. Leaves, petioles, etc. strongly glandular-dotted..... 64. *P. SAMBUANUM*
- jj. Leaves, etc. not glandular-dotted..... 65. *P. TECUMENSE*
- hh. Leaves 7-nerved on each side of the midrib, oblong-ovate, 10-13 cm. wide..... 66. *P. CRASSISPICATUM*
- cc. Stems and/or leaves more or less hairy (minutely and obscurely so in *P. callibracteum*).
- d. Leaves nerved from the lowermost ¼ or ⅓..... 67. *P. BOGOTENSE*
- dd. Leaves nerved mostly to about the middle or above.
- e. Leaf base with one side strongly auriculate and covering the petiole (auricle about 1 cm. or more long).
- f. Pubescence strongly dimorphic; leaves 6 cm. or more wide.... 68. *P. SPERDINUM*
- ff. Pubescence not dimorphic; leaves less than 5 cm. wide..... 69. *P. PERBREVICAULE*
- ee. Leaf base may be cordulate but scarcely auriculate.
- f. Leaves hairy on the upper surface, at least along the midrib above the very base.



- g. Leaves 10 × 25 cm. or more..... 85. *P. COLONENSE*
- gg. Leaves mostly smaller.
- h. Pubescence on the upper leaf surface restricted to the nerves.
- i. Nerves beneath glabrous; spike 2-3 cm. long..... 59a. *P. SEPTUPLINERVIUM*  
var. *SUBPUBINERVIUM*
- ii. Nerves beneath obviously hairy..... 70. *P. LEPTOCLADUM*
- hh. Pubescence not so restricted.
- i. Leaves 6-7 cm. wide, scarcely 3 times longer than wide; spikes straight.
- j. Crisp-hirtellous or subhispid above; young spikes short, bristly..... 49. *P. TABOGANUM*
- jj. Sparsely long-villous above, glabrescent; young spikes not noticeably bristly.
- k. Peduncle up to 6 cm. long; stem and leaf hairs strongly dimorphic..... 71. *P. DIMORPHOTRICHUM*
- kk. Peduncle much shorter; hairs not obviously dimorphic.
- l. Apex gradually acuminate, blades 15-20 cm. long..... 72. *P. PSEUDO-GARAGARANUM*
- ll. Apex abruptly acuminate, blades 12-14 cm. long..... 73. *P. CATIVALENSE*
- ii. Leaves mostly narrower, 3-4 times or more longer than wide, rugescent, appressed-pubescent above; spikes commonly curved.
- j. Nerves mostly 7-8 on each side; leaves mostly 3-5 cm. or more wide..... 74. *P. PSEUDO-LANCEAEFOLIUM*
- jj. Nerves mostly 4-5 on each side; leaves mostly 2-3.5 cm. wide..... 75. *P. LINEARIFOLIUM*
- ff. Leaves glabrous above.
- g. Fruit and ovary papillate-pubescent.
- h. Petioles scarcely 10 mm. long.
- i. Spikes 2-3 mm. × 7-8 cm.; plant vine-like..... 39. *P. VITABUNDUM*
- ii. Spikes 3-5 mm. × 4-5 cm.; plant shrubby..... 76. *P. PANAMENSE*
- hh. Petioles up to 3 cm. long; spikes 8-10 cm. long..... 77. *P. CALLIBRACTEUM*
- gg. Fruit glabrous, or unknown.
- h. Stems glabrous or essentially so.
- i. Leaf nerves beneath thinly strigose; bracts glabrous.... 78. *P. WEDELII*
- ii. Leaf nerves beneath obscurely puberulent; bracts fringed.
- j. Leaves 7-10 cm. wide..... 79. *P. VERRUCULAE-PETIOLUM*
- jj. Leaves less than 6 cm. wide..... 65. *P. TECUMENSE*
- hh. Stems obviously pubescent, at least when young.
- i. Leaf base narrowed, acute or obtusish, the sides nearly equal.
- j. Nerves beneath glabrous; spikes about 4-5 cm. long..... 80. *P. HIRTELLIPETIOLUM*
- jj. Nerves beneath pubescent; spikes 5-6 cm. long.... 80a. *P. HIRTELLIPETIOLUM*  
var. *TAPIANUM*
- ii. Leaf base with one or both sides rounded-obtuse, or the longer side mostly cordulate.
- j. Bracts conspicuously fringed; spikes 3-4 mm. thick.
- k. Lateral nerves loop-connected upward, not continuing toward the apex..... 81. *P. SUBCAUDATUM*
- kk. Lateral nerves not strongly loop-connected upward, continuing unbroken toward the apex..... 43. *P. CULEBRANUM*
- jj. Bracts essentially glabrous; spikes 7-8 mm. thick.... 82. *P. GONOCARPUM*

35. *PIPER DAVIDANUM* C.DC. in Smiths. Misc. Coll. 71<sup>b</sup>:9. 1920.

A shrub, 2 m. tall, nodose; flowering internodes moderately slender, glabrous, granular, with subnodal lenticels; leaves elliptic, apex rather short-acuminate, base inequilateral, one side 4–5 mm. shorter and acute, the longer side rounded, 6–9 cm. wide  $\times$  16–19 cm. long, glabrous on both sides, finely scabrous and glandular-dotted beneath, smooth above, pinnately nerved below the upper third, the nerves rather prominent beneath, 5–6 on each side, with slender cross-connecting and anastomosing nervules, drying pale green, membranous, translucent; petiole 6 plus 4–5 mm. long, vaginate at the base, glabrous; spikes 3 mm. thick  $\times$  8–10 cm. long; peduncle 5–7 mm. long, glabrous; bracts triangular-lunate-subpeltate, sparsely papillate-fringed; fruit oblong-tetragonous, granulate-papillate at the top, stigmas sessile.

Known only from the following locality.

CHIRIQUÍ: vicinity of David, along streamlet, alt. 30–80 m., *Pittier 2837*.

The glabrous stems and leaves, and scabrous lower leaf surface characterize this species.

36. *PIPER MINUTE-SCABIOSUM* Trel. in Ann. Mo. Bot. Gard. 27:294. 1940.

*Piper minute-scabiosum* var. *arborescens* Trel. loc. cit. 1940.

A shrub or small tree, up to 3 m. tall, somewhat twiggy, nodose; flowering internodes slender, lepidote-granular, glabrous; leaves narrowly elliptic or lance-elliptic, apex caudately acuminate, base inequilateral, acute or obtuse, one side 1–3 mm. shorter, 2.5–4 cm. wide  $\times$  9–15 cm. long, pinnately nerved from the lower half, the nerves 4 or 5 on each side, with inconspicuous cross-connecting nervules, glabrous and smooth above, scabrous and the nerves strigose-hairy beneath, glandular-dotted on both sides, drying rather firm, translucent; petiole 5–8 plus 1–3 mm. long, granular, vaginate at the base; spikes 2–3 mm. thick  $\times$  8 cm. long, cuspidate; peduncle 1–1.5 cm. long, glabrous; bracts triangular-lunate-subpeltate, rather sparsely short-fringed; ovary compressed-ovoid, papillate about the apex; stigmas sessile.

Known only from the following locality.

COCLÉ: north rim of El Valle de Antón, alt. 600–1000 m., *Allen 1639*; vicinity of El Valle, alt. 600–1000 m., *Allen 1185*; along Río Indio Trail, alt. 500–700 m., *Hunter & Allen 333*.

The only difference which can be noted between the type of the variety and that of the species is the collectors' notations of the habit of growth. Because of the great variation in this character it is not believed to be valid in this case. The species was described as a shrub 3 m. tall, and the variety as a small tree 2.5 m. tall.

37. *PIPER ADUNCUM* L. Sp. Pl. 1:29. 1753.

*Piper elongatum* Vahl, Enum. Pl. 1:312. 1805, sensu Trelease in Contr. U. S. Nat. Herb. 26:36. 1927.

*Piper celtidifolium* H.B.K. Nov. Gen. & Sp. 1:50. 1815.

- Artanthe adunca* Miq. Comm. Phyt. 49. 1838.  
*Steffensia adunca* Kunth, in Linnaea 13:633. 1939.  
*Artanthe celtidifolia* Miq. Syst. Pip. 452. 1848.  
*Piper fatoanum* C.DC. in Smiths. Misc. Coll. 71<sup>6</sup>:7. 1920.  
*Piper aduncum* var. *laevifolium* C.DC. loc. cit. 8. 1920.  
*Piper elongatum* var. *laevifolium* (C.DC.) Trel. in Contr. U. S. Nat. Herb. 26:37. 1927.  
*Piper intersitum* Trel. in H. Daniel, Una Ascension Al Cerro de "La Vieja," Medellín, Colombia, 12. 1940, in part.  
*Piper intersitum* var. *porcecitense* Trel. loc. cit. 13. 1940.

Shrub or small tree, mostly 3–9 m. tall, nodose; flowering internodes rather slender, short, rather sparsely pubescent glabrescent; leaves lanceolate to subelliptic, 4–8 or scarcely 10 cm. wide  $\times$  12–24 cm. long, apex sharp-acuminate, base inequilaterally rounded or cordulate, one side mostly 3–4 mm. shorter, pinnately nerved to the middle or upper third, the nerves 6–8 on each side, sharply ascending, the innermost meeting at the apex, gradually approximated downward with usually 2 or 3 on each side very near the base, scabrous and more or less pubescent above, at least along the nerves, commonly tardily somewhat rugulose, pubescent or glabrescent between the nerves and somewhat glandular-dotted beneath, the nerves commonly subappressed-hairy, drying firm, translucent, pellucid-dotted; petiole 3–8 plus 3–4 mm. long, pubescent, vaginate at the base; spikes 3–4 mm. thick  $\times$  8–15 cm. long, short-cuspidate, gradually curved or hooked; peduncle slender, 8–20 mm. long, mostly about 10–12 mm., puberulent; bracts triangular- or rounded-subpeltate, marginally fringed; fruit small, obovoid, more or less tri- or tetragonous, glabrous, stigmas sessile.



Fig. 6. *Piper aduncum*

West Indies and on the mainland through Central America and northern South America.

BOCAS DEL TORO: Cricamola Valley, vicinity of Almirante, *Cooper 531*; Isla Colón, alt. 0–120 m., *von Wedel 515*. CANAL ZONE: vicinity of Fort Sherman, *Standley 30941*; near Río Medio, Battery 46 Hill, *Miller 1770*; near old Fort Lorenzo, mouth of Río Chagres, *Piper 5985*; between Chagres Batteries and Fort San Lorenzo, Fort Sherman Military Reservation, *Maxon & Valentine 6992*; hills west of the canal, near Gatún, *Standley 27256*; alluvial bottom near Bohio, alt. 10–20 m., *Maxon 4766*; Madden Dam Road, *Miller 1803*. COLÓN: along the beach between Fató and Playa de Damas, *Pittier 3935, 3930*; forests around Porto Bello, alt. 5–100 m., *Pittier 2438*. PANAMÁ: near Tapia River, Juan Díaz region, *Maxon & Harvey 6671*; Tumba Muerto Road, near Panamá, *Standley 29803*; forests, on dry limestone, around Alhajueta, Chagres Valley, alt. 30–100 m., *Pittier 3510*.

37a. *PIPER ADUNCUM* var. **brachyarthrum** (Trel.) Yuncker, comb. nov.

*Piper clongatum* var. *brachyarthrum* Trel. in Contr. U. S. Nat. Herb. 26:37. 1927.

*Piper Cuatrecasasi* Trel. in Trab. Mus. Nac. Hist. & Jard. Bot. Madrid, Ser. Bot. 33:48. 1936.

*Piper cumbricola* Trel. loc. cit. 1936.

*Piper cumbricola* var. *montevagum* Trel. loc. cit. 1936.

*Piper illudens* Trel. loc. cit. 50. 1936.

Stems densely hirsute-villous; leaves moderately to densely soft-villous beneath. Occurs with the species.

PANAMÁ: without locality, *Seemann 117*. CHIRIQUÍ: vicinity of El Boquete, alt. 1000–1300 m., March 2–8, 1911, *Maxon 5139* (U. S. Nat. Herb., TYPE). VERAGUAS: vicinity of Santiago, alt. 50 m., *Allen 1016*. COCLÉ: El Valle, *Miller 1815, 1816*. CANAL ZONE: Chiva-Chiva Trail, Red Tank to Pueblo Nuevo, *Piper 5749*.

This is a widespread species which exhibits considerable variation in the size of the leaves and character and amount of pubescence. The rather slender, regularly curved spikes, short petioles, and somewhat longer peduncles are characteristic features. Variety *laevifolium* has slightly less scabrous leaves but otherwise agrees in all respects.

38. *PIPER HISPIDUM* Sw. Prodr. Veg. Ind. Occ. 15. 1788.

*Piper scabrum* Sw. Fl. Ind. Occ. 1:59. 1797.

*Piper hirsutum* Sw. loc. cit. 60. 1797.

*Steffensia hirsuta* Kunth, in Linnaea 13:640. 1839.

*Steffensia scabra* Kunth, loc. cit. 1839.

*Artanthe hirsuta* Miq. Syst. Pip. 446. 1844.

*Artanthe scabra* Miq. loc. cit. 447. 1844.

*Piper erectamentum* C.DC. in Smiths. Misc. Coll. 71<sup>6</sup>:14. 1920.

*Piper scabrilibum* C.DC. in Candollea 1:121, 276. 1923.

*Piper Williamsii* Trel. in Contr. U. S. Nat. Herb. 26:32. 1927.

*Piper Killipi* Trel. loc. cit. 33. 1927.

*Piper Killipi* var. *calderanum* Trel. loc. cit. 1927.

*Piper sancti-felicis* Trel. loc. cit. 35. 1927.

*Piper rivi-vetusti* Trel. in Ann. Mo. Bot. Gard. 24:186. 1937.

*Piper barbirostre* Trel. loc. cit. 27:288. 1940.

*Piper casitense* Trel. loc. cit. 289. 1940.

*Piper cerro-puntoense* Trel. loc. cit. 1940.

*Piper konkintoense* Trel. loc. cit. 293. 1940.

*Piper Margaretae* Trel. loc. cit. 1940.

*Piper pervicax* Trel. loc. cit. 296. 1940.

*Piper pseudo-viridicaule* Trel. var. *nivecitanum* Trel. loc. cit. 1940.

A shrub, up to 5–8 m. or more tall, rather nodose; flowering internodes moderately slender and rather short, hispid, sometimes glabrescent downward, hairs rigid, commonly more dense about the nodes, erect to reflexed, often of varying lengths; leaves elliptic or elliptic-ovate, 4–11 cm. wide  $\times$  11–20 or 25 cm. long, mostly 6–8  $\times$  11–15 cm., apex acuminate, base obliquely inequilateral, one side 2–5 mm. shorter, mostly acute, the longer side usually rounded and obtuse, or in large leaves sometimes cordulate, pinnately nerved from the

lower half, the nerves 5-6 on each side or 7 in some large leaves, with cross-connecting nervules, sometimes rugescent in age, lepidote-scabrous, more or less hirtellous or hispid along the nerves above, the nerves beneath hispid-hirsute, commonly glandular-dotted, drying papery, translucent; petiole 5-10 plus 2-5 mm. long, hirtellous or hispid, vaginate at the base; spikes 3 mm. thick  $\times$  8-14 cm. long, mucronate; peduncle rather thick, scarcely 1 cm. long, hirtellous or hispid; bracts triangular-subpeltate, marginally fringed; fruit rather small, oblong-subpyramidal-trigonous, laterally compressed, papillate-puberulent at the truncate or depressed apex; stigmas small, sessile.

In a number of scarcely distinguishable forms throughout the West Indies, Central America, and much of South America.



Fig. 7. *Piper hispidum*

BOCAS DEL TORO: Río Cricamola, between Finca St. Louis and Kontintoë, alt. 10-50 m., Woodson, Allen & Seibert 1894; vicinity of Nievécita, alt. 0-50 m., Woodson, Allen & Seibert 1829; Daytona Farm, region of Almirante, Cooper 165. CHIRIQUÍ: vicinity of "New Switzerland," central valley of Río Chiriquí Viejo, alt. 1800-2000 m., Allen 1365; valley of the upper Río Chiriquí Viejo, vicinity of Monte Lirio, alt. 1300-1900 m., Seibert 192; on trail to Cerro Punta, White 52, 158; Bajo Chorro, Boquete Distr., alt. 1800 m., Davidson 58, 342; El Boquete, alt. 1400-1650 m., Killip 3549; around Las Sigüas Camp, southern slope of Cerro de la Horqueta, alt. 1700 m., Pittier 3191; Río Caldera, above El Boquete, alt. 1600 m., Killip 3544; vicinity of San Felix, alt. 0-120 m., Pittier 5124; vicinity of Casita Alta, Volcán de Chiriquí, alt. 1500-2000 m., Woodson, Allen & Seibert 843, 902, 978. CANAL ZONE: Empire, Miller 1868; Barro Colorado Island, Gatún Lake, Standley 31387. PANAMÁ: Marraganti and vicinity, alt. 3-60 m., Williams 986; Indio, Madden Lake, Miller 2064. DARIÉN: Boca de Pauarandó, on Sambú River, alt. 20 m., Pittier 5584—some of the leaves on this specimen are up to 10-11  $\times$  22-24 cm.

38a. *PIPER HISPIDUM* var. *trachydermum* (Trel.) Yuncker, comb. nov.

*Piper trachydermum* Trel. in Contr. U. S. Nat. Herb. 26:33. 1927.

*Piper non-retrorsum* Trel. loc. cit. 36. 1927.

Differs from the species in having the short, stout hairs on the upper internodes upwardly curved and more or less appressed.

Occurs with the species.

PANAMA: without location, 1859-60, Hayes 791 (Herb. New York Bot. Gard., TYPE of *P. trachydermum*). COCLÉ: El Valle, valley floor and lower slopes, along highway, Miller 1817—leaves on this specimen are larger than usual. CANAL ZONE: Barro Colorado Island, Gatún Lake, alt. 120 m., Standley 40872; vicinity of Fort Sherman, Standley 30121. COLÓN: around Porto Bello, alt. 5-100 m., Pittier 2429. PANAMÁ: Río Tapia, Standley 28208.

38b. *PIPER HISPIDUM* var. **ellipticifolium** Yuncker, var. nov.

Caule hispido (pilis rigidis seorsum recurvantibus); foliis ellipticis, deorsum ad basem sensim angustatis, basi utrinque peracutis.

Stem hispid, the hairs rigid, upcurved; leaves elliptic, gradually narrowed to the base which is scarcely rounded and strongly acute on both sides, 7–8 cm. wide  $\times$  13–16 cm. long.

Known only from the type locality.

COCLÉ: Bismarck, above Penonomé, alt. 600–900 m., March 5–19, 1908, *Williams 343* (Herb. New York Bot. Gard., TYPE).

There is a great amount of variation in the size and to a lesser degree also the shape of the leaves on the specimen included here. All agree in having harshly scabrid leaves, hispid stems, and papillate-puberulent fruit. A study of the type specimens of the numerous species proposed by DeCandolle and by Trelease has failed to show any consistent characters upon which it is believed specific distinctions can be justified.

39. *PIPER VITABUNDUM* Trel. in *Contr. U. S. Nat. Herb.* 26:38. 1927.

*Piper conscendens* Trel. in *Field Mus. Nat. Hist. Bot. Ser.* 18:338. 1937.

Climbing; flowering internodes rather slender and long, moderately retrorse-strigose; leaves elliptic, apex acuminate, base inequilateral, one side 1–3 mm. shorter and acutish, the longer side acutish or obtuse, 3–4 cm. wide  $\times$  10–12 cm. long, pinnately nerved from the lower half, the nerves 4–5 on each side, lepidote, finely scabrous, and glabrous above, the nerves beneath appressed-pubescent, drying dark, subopaque; petiole about 5 plus 1–3 mm. long, pubescent, vaginate at the base; spikes 2–3 mm. thick  $\times$  7–8 cm. long; peduncle scarcely 1 cm. long, sparsely crisp-pubescent; bracts triangular-subpeltate, narrowly fringed; fruit oblong-subtetragonous, laterally compressed, papillate-puberulent at the top, stigmas sessile.

Known only from Changuinola Valley, Bocas del Toro.

BOCAS DEL TORO: Changuinola Valley, *Dunlap 338*.

The vine-like habit of this species is distinctive. *P. conscendens* was based on the same collection as *P. vitabundum*.

40. *PIPER PERSUBULATUM* C.DC. in *Smiths. Misc. Coll.* 71<sup>6</sup>:4. 1920.

Shrub (?); flowering internodes rather slender and short, densely brown-villous, the hairs up to 1 mm. or more long; leaves lance-elliptic-oblong, with the midrib nearer one side, apex very narrowly long-acuminate, base subequally rounded, 5.5–8 cm. wide  $\times$  19–24 cm. long, pinnately nerved from the lower half, the nerves 6–7 on each side, with prominent cross-connecting nervules, the upper surface somewhat scabrous, loosely villous, the nerves rather densely so, marginally strongly long-ciliate, more densely dingy-hairy beneath, drying papery, subopaque; petiole scarcely 5 mm. long, densely villous, vaginate at the base; spikes 2 mm. thick  $\times$  10 cm. long; peduncle scarcely 5 mm. long, villous; bracts subpeltate, densely dingy-hairy; ovary elongated with the rachis, glabrous, stigmas sessile.

Known only from the following locality.

COLÓN: Loma de la Gloria, near Fató (Nombre de Dios), *Pittier 4240*.

The densely villous stems and leaves, long, slenderly acuminate leaves, and densely hairy bracts distinguish this species.

41. *PIPER PERACUMINATUM* C.DC. in *Smiths. Misc. Coll.* 71<sup>6</sup>:9. 1920.

A shrub or small tree, 2–3 m. tall; flowering internodes moderately short and stout, hirsute, the hairs of various lengths; leaves elliptic-obovate, apex narrowly sharp-acuminate, base inequilateral, cordulate, the longer side 2–4 mm. longer at the petiole and covering the petiole, 8–13 cm. wide  $\times$  16–27 cm. long, scabrous above and loosely villous or at least pubescent along the nerves, thinly long-hairy beneath, ciliate, somewhat rugescent or nearly smooth, pinnately nerved from the lower half, the nerves 6 or 7 on each side, drying rather thin, subtranslucent; petiole 5–10 plus 2–4 mm. long, densely hirsute, vaginate-winged to the blade; spikes 5 mm. thick  $\times$  10–13 cm. long; peduncle rather stout, 2 cm. long, with intermixture of short, stiff, and long, crisp hairs; bracts rounded- or triangular-subpeltate, fringed, pedicel villous; fruit oblong, compressed, rusty-hirtellous, stigmas sessile.

Panama.

CANAL ZONE: Chagres, *Fendler 269*. COLÓN: around Dos Bocas, Río Fató valley, alt. 40–80 m., *Pittier 4210*; Río Indio de Fató, *Pittier 4254*.

The rather large, scabrid, cordulate-based leaves, mixture of long and short stiff hairs, and hairy fruits distinguish this species.

42. *PIPER ERUBESCENTISPICUM* Trel. in *Ann. Mo. Bot. Gard.* 27:291. 1940, as *erubescensipica*.

A shrub, 2 m. tall, nodose; flowering internodes rather short and slender, evanescently villous; leaves rhombic-elliptic, apex sharp-acuminate, base inequilateral, cordulate, one side 2–4 mm. shorter, 4–6.5 cm. wide  $\times$  10–14 cm. long, pinnately nerved from the lower half, the nerves 4–5 on each side, with rather prominent cross-connecting nervules, harshly scabrous, sparsely villous above, the hair bases enlarged, whitish, loosely villous beneath, at least along the nerves, the hairs more or less erect, up to 1 mm. or more long, marginally ciliate, young leaves woolly-villous when unfolding, drying papery, translucent; petiole scarcely 5 plus 2–4 mm. long, at first villous, vaginate at the base; spikes red, as reported, 2 mm. thick  $\times$  6 cm. long; peduncle about 5 mm. long, glabrescent; bracts glabrous, triangular-subpeltate, dorsally somewhat projected and callose, slightly ciliate beneath; fruit not developed, stigmas sessile.

Bocas del Toro.

BOCAS DEL TORO: vicinity of Nievecita, alt. 0–50 m., *Woodson, Allen & Seibert 1817*; Sansan Swamp, region of Almirante, *Cooper 190*.

The villous, more or less rhombic-elliptic, scabrous leaves, red spikes, and irregularly shaped bracts distinguish this species.

43. *PIPER CULEBRANUM* C.DC. in *Candollea* 1:121, 243. 1923.

A shrub or small tree, 2 m. tall; upper internodes comparatively short and slender, loosely to moderately crisp-villous; leaves elliptic, elliptic-oblongate or elliptic-subobovate, apex acutely long-acuminate, base 3–5 mm. shorter on one side, obtuse, or longer side cordulate, 5–7 or sometimes 9 cm. wide  $\times$  15–20 cm. long, pinnately nerved from the lower half, the nerves 4–5 on each side, with cross-connecting and anastomosing nervules, sparsely white-villous glabrescent above, mostly crisp-villous and slightly scabrous beneath, the nerves more densely so, drying rather thin, green, somewhat glossy, translucent; petiole mostly about 5 plus 3–5 mm. long, crisp-villous, vaginate at the base; spikes 4 mm. thick  $\times$  7–9 cm. long; peduncle 1 cm. long, crisp-villous; bracts round-triangular-subpeltate, with a wide, dense yellow fringe; fruit subcylindrical, truncate; stigmas sessile.

Central Panama.

CANAL ZONE: Empire, *Miller 1866*; near Fort Randolph, *Standley 28622, 28667*. COLÓN: along the Río Culebra, above Santa Isabel, near sea-level, *Pittier 4154*; between France Field, Canal Zone and Catival, *Standley 30375*. PANAMÁ: Juan Díaz, *Standley 30611*; along Río Juan Díaz above Juan Díaz, alt. 30 m., *Allen 934*.

There is considerable variation in the size of the leaves on the specimens included here, especially *Miller's No. 1866*, but they agree very well otherwise, and it is believed they all represent the same species.

44. *PIPER VIRIDICAULE* Trel. in *Contr. U. S. Nat. Herb.* 26:32. 1927.

A shrub, 2 m. tall, branches subdichotomously forked; flowering internodes slender, elongating downward, villous, the hairs up to 1 mm. or more long; leaves lance-elliptic, apex sharp-acuminate, base inequilateral, cordulate, one side 2–4 mm. longer and covering the petiole, 3–4.5 cm. wide  $\times$  9–12 cm. long, pinnately nerved from the lower half, the nerves 4 or occasionally 5 on each side, with slender cross-connecting nervules, sparsely villous and harshly scabrous above, paler beneath and appressed-villous, especially along the nerves, marginally long-ciliate, pale-glandular-dotted beneath, drying thin, translucent; petiole 5–20 plus 2–4 mm. long, villous, vaginate at the base; spikes unknown.

Known only from Barro Colorado Island.

CANAL ZONE: Barro Colorado Island, Gatún Lake, *Standley 31402*.

The absence of inflorescence on the only specimen known of this species makes its position questionable. The vegetative characters, especially the villous twigs and leaves, distinguish it from any other known species.

45. *PIPER PERVELUTINUM* Trel. in *Contr. U. S. Nat. Herb.* 26:39. 1927.

Shrub (?), nodose; flowering internodes short, rather stout, densely subvillous; leaves lance-oblong, apex subacuminate, base inequilateral, rounded, obtuse, one side 2–5 mm. shorter, the upper surface rugose, scabrous, hirsute, especially along the nerves, dull, densely dingy-villous and slightly scabrous beneath, not ciliate, pinnately nerved from the lower half, the nerves 6–7 on each side, impressed above,



gradually approximated downward, drying rather thick, opaque; petiole 8–10 plus 2–5 mm. long, densely dingy-villous, clasping and vaginate at the base; spikes as yet immature, 2 mm. thick  $\times$  1.5 cm. long; peduncle short, densely hairy; bracts round-subpeltate, fringed, the dorsal hairs much longer; ovary not formed.

Known only from the one specimen.

PANAMA: without locality, *Hayes 796*.

46. *PIPER variitrichum* Yuncker, sp. nov.

Frutex 1–2 m. altus, caulibus nodosis; internodiis floriferis gracilibus conferte atro-pubescentibus; foliis ovato-ellipticis, apice acute acuminatis, basi inaequaliter obliquis, latere angusto obtuso vel acuto, latere lato rotundato cordulato, supra conferte scabridis, a tertio supero deorsum pinnatim venosis, venis utrinque 5–6, supra hispidis subtus pubescentibus, ad venas sat conferte hirsutis, pilis erectis brevioribus longioribusque intermixtis; petiolo 1–1.5 cm. longo, conferte hirsuto, deorsum vaginato; spicis immaturis 2 mm. crassis, 4 cm. longis apiculatis; pedunculo 5 mm. longo conferte pubescente; bracteis rotundato-subpeltatis fimbriatis.

Shrub, 1–2 m. tall, nodose; flowering internodes slender, lengthening downward, densely dingy-pubescent; leaves ovate-elliptic, apex narrowly attenuately acuminate, base inequilaterally oblique, essentially equal length at the petiole, the narrower side narrowing downward, obtuse or acutish, the broader side rounded, cordulate, 6–8 cm. wide  $\times$  15–23 cm. long, harshly scabrous above, less so beneath, pinnately nerved below the upper third, the nerves 5–6 on each side, with slender, cross-connecting nervules, glandular-dotted and hispid above, pubescent beneath with the nerves rather densely starry-hairy with a mixture of various length hairs, scarcely ciliate, drying rather thin, translucent; petiole 1–1.5 cm. long, densely hairy, vaginate toward the base; spikes as yet young, 2 mm. thick  $\times$  4 cm. long, apiculate; peduncle 5 mm. long, densely pubescent; bracts round-subpeltate, fringed, with a few dorsal hairs longer; ovary and fruit not developed.

Known only from the type locality.



Fig. 8. *Piper variitrichum*

DARIÉN: Chepigana Distr., Caña-Cuasi Trail (Camp 2), alt. 600 m., March 9, 1940, *Terry & Terry 1428* (Herb. Missouri Bot. Gard., TYPE).

The comparatively large leaves, narrowly acuminate apex, the margins essentially equal at the petiole, and various length hairs on the nerves beneath distinguish this species.

47. *PIPER CHANGUINOLANUM* Trel. in Contr. U. S. Nat. Herb. 26:37. 1927.

A nodose shrub with scabrous twigs and leaves; flowering internodes short and comparatively slender, finely hispid and granular; leaves inequilateral, narrowly elliptic-oblong, apex acuminate, base 2–4 mm. shorter on one side and acute, the longer side rounded, cordulate, 3–4 cm. wide  $\times$  12–15 cm. long, pinnately nerved from below the middle, the nerves 5–6 on each side, rather slender but conspicuous beneath, with slender cross-connecting nervules, slightly rugose in age, the nerves above hispidulous, paler and granular-dotted beneath and appressed-pubescent on the nerves, appressed-hispidulous ciliate, drying papery, translucent; petiole scarcely 5 plus 2–4 mm. long, hispid, vaginate at the base; spikes 3 mm. thick  $\times$  8–10 cm. long; peduncle scarcely 1 cm. long, subappressed-hispid; bracts rounded-triangular-subpeltate, thinly stiff-ciliate, the anterior setae longer; fruit oblong, laterally-compressed, apex depressed-truncate, granulate or essentially glabrous, stigmas sessile.

Known only from Changuinola Valley, Bocas del Toro.

BOCAS DEL TORO: Changuinola Valley, *Dunlap 233*.

48. *PIPER VILLIRAMULUM* C.DC. in Smiths. Misc. Coll. 71<sup>6</sup>:11. 1920.

*Piper bocasense* Trel. in Field Mus. Nat. Hist. Bot. Ser. 18:333. 1937.

*Piper yapeanum* Trel. in Ann. Mo. Bot. Gard. 25:827. 1938.

A shrub or small tree, commonly 2–3 m. tall; flowering internodes moderately slender, moderately to rather densely villous; leaves ovate or elliptic-ovate, apex acuminate, base inequilaterally oblique, one side 3–5 mm. shorter and obtuse, the longer side rounded, cordulate, mostly 5–8 cm. wide  $\times$  13–18 cm. long, occasional leaves somewhat larger, scabrous on both sides but more harshly so above, moderately appressed-hairy on both sides, becoming somewhat bullulate, pinnately nerved from the lower half, the nerves 6 or 7 on each side, drying rather thin, translucent; petiole 5–10 plus 3–5 mm. long, vaginate at the base, moderately to densely villous; spikes 3 mm. thick  $\times$  7–9 cm. long; peduncle rather stout, scarcely 5 mm. long, hairy; bracts rounded-triangular-subpeltate, fringed, the hairs comparatively short, coarse and somewhat rigid; fruit tetragonous, laterally compressed, glabrous or obscurely papillate at the apex, stigmas sessile.

Panama.

BOCAS DEL TORO: region of Almirante, *Cooper 407*; Changuinola Valley, *Dunlap 234*; vicinity of Chiriquí Lagoon, *von Wedel 1215*; Water Valley, *von Wedel 608, 1777, 2660*; Shepherd Island, *von Wedel 2679*—this specimen is more rugose than usual. CANAL ZONE: Río Pedro Miguel, near East Paraíso, *Standley 29966*; around El Paraíso, alt. 30–100 m., *Pittier 2534*; Corozal, *Stevens 124*; *Riley 138*; along the old Las Cruces Trail, between Fort Clayton and Corozal, *Standley 29199*; between Miraflores and Corozal, alt. 20–30 m.,

*Pittier 2193*; Las Cascadas Plantation, near Summit, *Standley 25692, 25701, 26012*; Summit, *Standley 26937*; Cerro Gordo, near Culebra, *Standley 25998*; Balboa, *Standley 26073, 29267*; Gamboa, *Standley 28522*; Empire, *Miller 1869*; Empire to Mandinga, *Piper 5514*; vicinity of Ancón, *Piper 6028*; Bro. *Celestine 32*; Río Agua Salud, near Frijoles, *Piper 5867*; near Río Medio, Madden Dam Road, *Miller 1768, 1769, 1771, 1802*; vicinity of Madden Dam, near Río Chagres, alt. 50–75 m., *Seibert 549*; near old Fort Lorenzo, mouth of Río Chagres, *Piper 5971*. COLÓN: Loma de la Gloria, near Fató (Nombre de Dios), alt. 10–104 m., *Pittier 4083*. PANAMÁ: Sabana de Juan Corso, near Chepo, alt. 60–80 m., *Pittier 4537*; along the Corozal Road, near Panamá, *Standley 26843*; Juan Díaz, *Standley 30623*; Río Tapia, *Standley 28134*; 3 miles east of Juan Díaz, alt. 75 m., *Killip 3123*; Bella Vista, *Macbride 2732*; Camino de La Granja, Bro. *Heriberto 165*. DARIÉN: near mouth of Río Yapé, alt. 20 m., *Allen 351*.

48a. *PIPER VILLIRAMULUM* var. *GAMBOANUM* (C.DC.) Trel. in *Contr. U. S. Nat. Herb.* 26:36. 1927.

*Piper gamboanum* C.DC. in *Candollea* 1:249. 1923.

*Piper hispidum* Sw. var. *gamboanum* C.DC. in *Smiths. Misc. Coll.* 71<sup>6</sup>:12. 1920.

*Piper gamboanum* var. *yapense* Trel. in *Ann. Mo. Bot. Gard.* 27:291. 1940.

Leaves 2–4 or occasionally up to 4.5–5 cm. wide.

Occurs with the species.

CANAL ZONE: around Gamboa, alt. 20–100 m., *Pittier 3410*; Corozal, *Stevens 116, 117*; foot of Corozal Hill, *Miller 1788*; along the old Las Cruces Trail, between Fort Clayton and Corozal, *Standley 29048*; Las Cascadas Plantation, near Summit, *Standley 29639*; Obispo, *Standley 31794*. PANAMÁ: near the big swamp, east of Río Tecumen, *Standley 26598*; between Las Sabanas and Matías Hernández, *Standley 31818*. DARIÉN: vicinity of Yapé, *Allen 854*.

The appressed-villous, scabrous, bullulate leaves, and short, stout peduncles characterize this species and distinguish it from *P. taboganum* in which the leaves are less scabrous, scarcely bullulate, more densely hairy, and with longer peduncles. The young spikes of *P. taboganum* are also usually very short and bristly from the erect bract hairs. The type of *P. yapeanum* is reported as a tree 15 m. tall. The type specimen agrees in all other respects with those reported as being much smaller plants.

49. *PIPER TABOGANUM* C.DC. in *Smiths. Misc. Coll.* 71<sup>6</sup>:4. 1920.

*Piper obaldianum* C.DC. loc. cit. 7. 1920.

*Piper dumeticola* C.DC. var. *panamense* C.DC. loc. cit. 1920.

*Piper pallidibracteum* C.DC. loc. cit. 8. 1920.

*Piper salinasanum* C.DC. var. *parvifolium* C.DC. in *Ann. Conserv. & Jard. Bot. Genève* 21:234. 1920.

*Piper barbinerve* Trel. in *Contr. U. S. Nat. Herb.* 26:35. 1927.

*Piper Bigelovii* Trel. loc. cit. 23. 1927.

*Piper subdilatum* Trel. loc. cit. 35. 1927.

*Piper chagresianum* Trel. loc. cit. 37. 1927.

*Piper breve* C.DC. in Trel. loc. cit. 38. 1927.

*Piper breve* var. *pallidineurum* Trel. loc. cit. 1927.

*Piper breve* var. *pseudo-dumeticola* Trel. loc. cit. 1927.

*Piper breve* var. *bellae-vistae* Trel. loc. cit. 39. 1927.

*Piper breve* var. *divaricatum* Trel. loc. cit. 1927.

*Piper breve* var. *pseudo-fatoanum* Trel. loc. cit. 1927.

*Piper cayzasense* Trel. in *Ann. Mo. Bot. Gard.* 25:826. 1938.

*Piper amphibium* Trel. loc. cit. 27:288. 1940.

*Piper insulicolum* Trel. loc. cit. 293. 1940.

*Piper tabernillanum* Trel. var. *anconense* Trel. loc. cit. 298. 1940.

*Piper tembladorese* Trel. in Ll. Williams, Expl. Bot. Guyana Venez. 177. 1942 (Serv. Bot. Minist. Agr. y Cria).

A shrub, mostly 1–3 m. tall; upper internodes rather short and slender, soft-villous, crisp-pubescent, or subhispid, more or less canescent; leaves rhombic-subobovate, elliptic, or less commonly lance-elliptic, mostly 4–6 cm. wide  $\times$  10–15 cm. long, or occasional leaves up to 9  $\times$  22 cm., apex acuminate, narrowed downward to the inequilaterally rounded base, one side commonly 2–5 mm. shorter, the longer side obtuse or cordulate, pinnately nerved from below the middle, the nerves 5–6 or sometimes 7 on each side, often slightly rugescent near the margin or toward the base, crisp-hirtellous or subhispid above with the midrib densely so, somewhat scabrous from the persistent hair bases, soft-pubescent beneath, the nerves usually densely so, the hairs appressed, drying rather thin, translucent; petiole 5–10 or occasionally up to 20 plus 2–5 mm. long, densely hairy, vaginate commonly to the middle or above, the groove smooth or hairy within; spikes scarcely 1 cm. long when young and more or less bristly from the suberect bract hairs, becoming 3–4 mm. thick  $\times$  4–10 cm. long, commonly apiculate; peduncle mostly 5–10 or occasionally up to 20–25 mm. long, pubescent; bracts rounded or triangular-subpeltate, marginally fringed, the hairs rather stiff, those on the dorsal margin usually longer and suberect in young spikes; fruit oblong-subtrigonous, glabrate or slightly papillate when young; stigmas small, sessile.

Northern South America and Panama.

PANAMÁ: without locality, *Bigelow s. n.*; *Née* 358, 365. CHIRIQUÍ: Boquete District, Boquete, alt. 1140 m., *Davidson* 617. VERAGUAS: trail between Cañazas and the foot of the Cordillera Central, headwaters of Río Cañazas, alt. 300–600 m., *Allen* 185. COCLÉ: vicinity of Olá, alt. 100–350 m., *Pittier* 5034; El Valle de Antón and vicinity, alt. 500–700 m., *Seibert* 436; El Valle, *Miller* 1818, 1819—small-leaved specimens—1820; between Aguadulce and Antón, alt. 15–50 m., *Woodson*, *Allen* & *Seibert* 1222; vicinity of Santa Clara beach, *Woodson*, *Allen* & *Seibert* 1705; between Las Margaritas and El Valle, *Woodson*, *Allen* & *Seibert* 1306, 1728. CANAL ZONE: Empire, *Miller* 1864, 1869; Empire to Mandinga, *Piper* 5523; near old Fort Lorenzo, mouth of Río Chagres, *Piper* 5944; between Chagres Batteries and Fort San Lorenzo, Fort Sherman Reservation, *Maxon* & *Valentine* 6986; vicinity of Fort Sherman, *Standley* 30918, 30982, 31149; western slope of Ancón Hill, vicinity of Balboa, alt. 20–75 m., *Seibert* 118, 119, 399; *Woodson*, *Allen* & *Seibert* 1327; *Standley* 25203, 26382, *Killip* 12078; Balboa, *Standley* 25420, 25603, 25565; 2 miles west of Balboa, *Correll* 12261; Las Sabanas, *Bro. Celestine* 110; *Riley* 116; *Cocli*, *Riley* 127; *Matachin*, *Cowell* 204; foot of Corozal Hill, *Miller* 1791; Corozal, *Standley* 27341; near Fort Randolph, *Standley* 28659; *Maxon* & *Harvey* 6504, 6543; Fort Kobe road, *Woodson*, *Allen* & *Seibert* 1412; Brazos Brook Reservoir, *Stevens* 752; Culebra, *Stevens* 993; alt. 50–150 m., *Pittier* 3445; around Gamboa, in thickets, alt. 40–80 m., *Pittier* 3709; *Standley* 28374, 28481; between Gamboa and Cruces, alt. 50–80 m., *Pittier* 3787; France Field, *Stevens* 981; Margarita Swamp, south of France Field, *Maxon* & *Valentine* 7055; between France Field, Canal Zone and Catival, Colón, *Standley* 30164; Mount Hope Cemetery, *Standley* 28776; Obispo, *Standley* 31764; Juan Mina, *Piper* 5692; Cerro Gordo, near Culebra, *Standley* 25975, 26018; Chivi-Chivi Trail, 2 miles above Red Tank, *Maxon* & *Harvey* 6591. COLÓN: Chagres, *Fendler* 268; Río Culebra, above Santa Isabel, *Pittier* 4148; Río Indio de Fató, near sea-level, *Pittier* 4271; along the beach between Fató and Playa de Damas, *Pittier* 3923, 3930. PANAMÁ: near Matías Hernández, *Standley* 28957;

near Las Sabanas, *Standley* 40779; between Las Sabanas and Matías Hernández, *Standley* 31832; Río Tapia, *Standley* 28103; near Tapia River, Juan Díaz Region, *Maxon & Harvey* 6620, 6626; Sabana de Juan Corso, near Chepo, alt. 60–80 m., *Pittier* 4539; Río Tecumen, *Standley* 29451; near big swamp east of Río Tecumen, *Standley* 26551; near Punta Paitilla, *Standley* 26303; *Stevens* 349; Juan Díaz, *Standley* 30637; Tumba Muerto Road, near Panamá, *Standley* 29724; Bella Vista, at sea-level, *Killip* 12045, 12004; *Piper* 5331; vicinity of Juan Franco Race Track, near Panamá, *Standley* 27713, 27734, 27777; Taboga Island, *Woodson, Allen & Seibert* 1527; *Standley* 27019, 27920; *Miller* 1845, 1846—a large-leaved specimen—, 1847; alt. 90 m., *Collenette* 487; *Killip* 3194; *Pittier* 3529; Taboguilla Island, *Miller* 2003; Perlas Archipelago, San José Island, *Johnston* 687, 1019, 1404; *Erlanson* 376—this specimen differs in having more elliptic-ovate leaves scarcely narrowed toward the base, but it agrees very well in other characters; Trapeche Island, *Miller* 1908, *Allen* 2618; Saboga Island, *Miller* 1951—a large-leaved specimen—1952. SAN BLAS: forests around Puerto Obaldía, alt. 0–50 m., *Pittier* 4366, 4396—a large-leaved specimen. DARIÉN: Chepigana District, Caña-Cuasi Trail, alt. 600 m., *Terry & Terry* 1428.

This species is one of the most common in Panama where it occurs in a great variety of scarcely differentiable forms. It appears to be rather closely related to *P. mollicomum* of Brazil, from which it differs, however, because of its mostly less venulose and more finely rugescent leaves which have the margins less rounded below the middle, and with generally shorter peduncles. The type specimen of *P. mollicomum* has not been examined by the writer and the above contrast is based on notes and sketches made by the late Professor Trelease from specimens in European herbaria. There is a considerable range in size and amount of pubescence shown by the leaves, often on the same specimen. The contrast between large-leaved and small-leaved specimens is very great. Other specimens, however, show intergradations in size to such an extent that it does not seem advisable to establish or maintain varieties based on this character alone. The type of *P. Bigelovii* is a rather poor specimen which appears to agree well with this species although it is somewhat more tomentose than usual for most of the specimens included.

50. PIPER PSEUDO-CATIVALENSE Trel. in Contr. U. S. Nat. Herb. 26:34. 1927.

Shrub, 2 m. tall; flowering internodes rather slender and somewhat elongate, crisp-pubescent; leaves elliptic or elliptic-ovate, apex bluntly short-acuminate, mucronate, base inequilaterally rounded, cordulate, larger leaves strongly so, equal at the petiole or one side about 2 mm. shorter, mostly 5–6 cm. wide  $\times$  10–13 cm. long, pinnately nerved from the lower half, the nerves 4–5 on each side, with cross-connecting-anastomosing nervules, scabrous, crisp-hairy on both sides, the nerves more densely so, the hairs on the nerves beneath upcurved, drying papery, translucent; petiole about 10 plus 2 mm. long, crisp-pubescent, vaginate to the middle or above; spikes as yet very young, bristly with the erect bract hairs; peduncle pubescent; ovary or fruit not developed.

Known only from the following locality.

COLÓN: France Field, Canal Zone, and Catival, *Standley* 30399.

The elliptic or somewhat ovate leaves, hairy on both sides, and with the base rounded-cordulate on both sides, and bristly young spikes distinguish this species. It is apparently closely related to *P. taboganum* but differs because of the shape of the leaf, and more rounded cordulate base.

51. PIPER LUCIGAUDENS C.DC. in Smiths. Misc. Coll. 71<sup>6</sup>:10. 1920.

*Piper pseudo-viridicaule* Trel. in Ann. Mo. Bot. Gard. 27:296. 1940.

A shrub or small tree, up to 3–4 m. tall, nodose; flowering internodes somewhat zigzag, slender and rather short, granular, sparingly crisp-pubescent; leaves elliptic or elliptic-oblongate, the midrib somewhat nearer one side, apex narrowly attenuately acuminate, base inequilateral, one side 2–5 mm. shorter, acute or the longer side more rounded and obtusish, 4–6 cm. wide  $\times$  13–17 cm. long, somewhat scabrous, pinnately nerved from the lower half, the nerves 4–5 on each side, with cross-connecting-anastomosing nervules, glabrous above, hirsute along the nerves beneath, the hairs suberect, mostly 0.5 mm. or more long, drying papery, green above, paler and glandular-dotted beneath, translucent; petiole about 5 plus 2–5 mm. long, somewhat hirsute, vaginate at the base; spikes as yet young, 2–3 mm. thick  $\times$  8–10 cm. long, peduncle up to 1 cm. long, granular, glabrous; bracts rounded- or triangular-subpeltate, narrowly and sparsely fringed; ovary or fruit not developed.

Panama.

CANAL ZONE: forest along the Río Indio de Gatún, near sea-level, *Pittier 2791, 2791a*; near Río Medio, *Miller 1766*; Barro Colorado Island, *Standley 31288, 31387*.

51a. PIPER LUCIGAUDENS var. **Alleni** (Trel.) Yuncker, comb. nov.

*Piper Alleni* Trel. in Ann. Mo. Bot. Gard. 25:826. 1938, not C.DC. 1910.

Tree 7 m. tall; flowering internodes more densely subhispid; leaves somewhat larger, hairs beneath on midrib appressed, less than 0.5 mm. long.

Known only from the type locality.

DARIÉN: trail between Pinogana and Yavisa, alt. 15 m., *Allen 270* (Herb. Univ. Ill., TYPE)—“Roots used by Indians to deaden pain, leaves used as snake bite remedy.”

The specimen upon which *P. pseudo-viridicaule* was based is sterile. It agrees very well in its vegetative characters with the others included here, and it is believed to be the same.

52. PIPER STORKII Trel. in Contr. U. S. Nat. Herb. 26:32. 1926.

Shrub (?), nodose, nearly glabrous; flowering internodes slender and short, granular, sparsely pubescent when young; leaves elliptic or lance-elliptic, the midrib nearer one side, apex attenuately acuminate, base strongly inequilateral, one side 2–3 mm. shorter, acute, the longer side rounded, obtuse, pinnately nerved from the lower half, the nerves 4–5 on each side, approximated downward, with cross-connecting-anastomosing nervules, 4–5 cm. wide  $\times$  14–16 cm. long, glabrous and somewhat scabrid above, very obscurely appressed-pubescent beneath, at least along the nerves, drying thin, green, translucent; petiole about 5 plus 2–3 mm. long, granular, glabrous, vaginate at the base; spikes as yet young, 2 mm. thick  $\times$  6 cm. long; peduncle scarcely 5 mm. long, stout, glabrous; bracts triangular-subpeltate, glabrous or with a few, short, ventral hairs; ovary and fruit not matured.

Known only from Bocas del Toro.

BOCAS DEL TORO: Rubber Tree Station, *Stork 124*.

The thin, nearly glabrous leaves, and essentially glabrous bracts characterize this species.

53. PIPER WAGNERI C.DC. in DC. Prodr. 16<sup>1</sup>:302. 1869.

*Piper minutispicum* C.DC. in Smiths. Misc. Coll. 71<sup>6</sup>:1. 1920.

*Piper Wagneri* var. *minutispicum* Trel. in Contr. U. S. Nat. Herb. 27:29. 1927.

A glabrous, nodose shrub; upper internodes relatively short and slender; leaves lance- or ovate-elliptic, apex moderately acuminate, base subequilateral, the margin equal at the petiole or with one side commonly 1–5 mm. shorter, acute or occasionally with the longer side subcordulate, 4–7 cm. wide  $\times$  10–14 cm. long, pinnately nerved from below the middle, the nerves 3–5 on each side, with fine, cross-connecting-anastomosing nervules, glandular-dotted beneath, drying rather papery, translucent; petiole 10–25 plus 1–5 mm. long, vaginate to the blade; spikes up to 4 mm. thick  $\times$  9 mm. long, mucronate; peduncle 5–8 mm. long; bracts concave-inflexed, glabrous; ovary glabrous, stigmas sessile.

Southwestern Panama.

CHIRIQUÍ: *Wagner*; oak-palm forest above Sabana de El Salto, above El Boquete, alt. 1500–1750 m., *Pittier 3116*.

DeCandolle described *P. minutispicum* as dioecious. The spikes on the type are very young and, as in young spikes generally, the ovary is scarcely developed. It is believed that specimens with mature spikes will show that the flowers are perfect. Otherwise, the types of *P. Wagneri* and *P. minutispicum* appear to be the same species. The glabrous stems and leaves and very short spikes are distinctive characters.

54. PIPER DUNLAPI Trel. in Contr. U. S. Nat. Herb. 26:23. 1927.

Shrub (?), nodose, glabrous; flowering internodes rather short and slender, glandular-dotted; leaves ovate or lance-ovate, apex gradually sharp-acuminate, base inequilateral, acute, or equilaterally rounded and obtuse, 3.5–5.5 cm. wide  $\times$  10–13 cm. long, pinnately nerved from below the upper third, the nerves about 4–5 on each side, with faint cross-connecting-anastomosing nervules, strongly glandular-dotted on both sides, drying rather thick, narrowly revolute, subtranslucent, glossy above, dull beneath; petiole 1–1.5 cm. long, vaginate at the base, or on larger leaves to the blade; spikes as yet immature, somewhat curved, apiculate, 3 mm. thick  $\times$  2–3 cm. long; peduncle slender, scarcely 1 cm. long; bracts round- or subquadrangular-subpeltate, densely yellow-fringed, the fringe hairs filiform; ovary and fruit not developed.

Known only from the following locality.

BOCAS DEL TORO: Changuinola Valley, *Dunlap 231*.

The glabrous stems and leaves, short spikes, and densely yellow-fringed bracts distinguish this species. It resembles *P. birtellipetiolum* var. *subtrinerve* to a considerable extent but differs because of its more rounded floral bracts which are scarcely umbonate when young, and with more filiform fringe hairs. The Gray Herbarium specimen, obviously the same collection as that of the type in the U. S. National Herbarium, has scarcely glandular-dotted leaves.

55. *PIPER PALMASANUM* C.DC. in Smiths. Misc. Coll. 71<sup>6</sup>:3. 1920.

A shrub; flowering internodes moderately slender, elongating downward, from very sparingly soft-pubescent quickly glabrescent; leaves ovate-lanceolate, apex gradually sharp-acuminate, base subequilaterally rounded or with one side 1–2 mm. shorter at the petiole, obtuse or abruptly acutish at the petiole, 3–5.5 cm. wide  $\times$  10–15 cm. long, pinnately nerved from below the middle, the nerves about 4 on each side, gradually closer together downward, impressed above, raised beneath, with cross-connecting-anastomosing nervules, glabrous above, the nerves beneath appressed-hairy, obscurely glandular-dotted beneath, drying firm, subtranslucent; petiole 5–15 mm. long, sparsely pubescent glabrescent, vaginate-winged to the middle; spikes yellow, as yet young, 2 mm. thick  $\times$  2 cm. long, mucronate; peduncle 5–10 mm. long, sparsely pubescent; bracts triangular-subpeltate, yellow-fringed; ovary and fruit not developed.

Known only from Cuesta de Las Palmas, Chiriquí.

CHIRIQUÍ: humid forest of Cuesta de Las Palmas, southern slope of Cerro de la Horqueta, alt. 1700–2100 m., *Pittier* 3225.

The relatively small, yellow spikes, and the character of the pubescence characterize this species.

56. *PIPER REPTABUNDUM* C.DC. in Bot. Gaz. 70:169. 1920.

"Repent or scandent," glabrous; flowering internodes slender and short, granular-scurfy; leaves strongly inequilaterally, somewhat falcately, oblong-elliptic, the margin on one side quite straight and subparallel with the midrib to near the apex, the other side strongly curved from the base to the tip, apex sharply acuminate, base inequilateral with one side about 2 mm. shorter, the longer side obtuse or cordulate-auriculate and covering the petiole, 3.5–5.5 cm. wide  $\times$  13–20 cm. long, pinnately nerved from below the upper third, the nerves 4–6 on each side, strongly curved toward the apex, with strong cross-connecting veinlets and finely nervulose with anastomosing nervules, finely granular beneath, drying rather firm, translucent; petioles nearly obsolete, 1–2 plus 2 mm. long, scurfy; spikes 2 mm. thick  $\times$  4–8 cm. long, somewhat curved; peduncle slender, 4–7 cm. long; bracts small, triangular-subpeltate, smooth or granular-papillate; fruit obpyriform-trigonous, granular-papillate; stigmas sessile.

Costa Rica and adjacent Panama.

BOCAS DEL TORO: Sibubi Falls, Sixaola Valley, *Rowlee & Rowlee* 392 (Cited as 372 by Trelease in Contr. U. S. Nat. Herb. 26:38. 1927).

The subarcuate leaf shape and very long peduncles strongly characterize this species.



57. PIPER CHIRIQUINUM C.DC. in Smiths. Misc. Coll. 71<sup>6</sup>:2. 1920.

*Piper paso-anchoense* Trel. in Ann. Mo. Bot. Gard. 27:295. 1940.

A shrub, 2–3 m. tall, glabrous, nodose; flowering internodes rather slender and short, smooth or with round lenticels; leaves ovate or lance-ovate, apex bluntly acuminate, base mostly rounded, acute or obscurely and shallowly cordate, abruptly contracted onto the petiole, 3.5–8 cm. wide  $\times$  8–14 cm. long, pinnately nerved from below the upper third, the nerves 3–4 on each side in small leaves or 4–5 in larger leaves, with 2 or 3 pairs from near the base and 1 or 2 pairs above, with a few shorter intermediates and cross-connecting-anastomosing nervules, drying firm, pale green, translucent; petiole 10–25 mm. long, vaginate at the base or occasionally to about the middle; spikes 2–3 mm. thick  $\times$  5–8 cm. long, usually mucronate; peduncle 5–10 mm. long; bracts rhomboid-subpeltate, umbonate, submarginally ciliate; fruit obpyramidal-trigonous, glabrous, stigmas sessile.

Panama.

CHIRIQUÍ: pastures around El Boquete, alt. 1000–1300 m., *Pittier 2930*; *Maxon 4944*; *Davidson 725*; forests along the Río Ladrillo and vicinity, above El Boquete, alt. 1200–1300 m., *Maxon 5557*, *5558*; trail from Paso Ancho to Monte Lirio, upper valley of Río Chiriquí Viejo, alt. 1500–2000 m., *Allen 1579*.

This species bears some resemblance to *P. aequale* from which it is to be distinguished, however, because of the leaf shape and type of venation. The type of forma *b* has smaller leaves but the range in size of leaves on the different specimens is so great that it is not believed that it merits recognition.

58. PIPER TENUIMUCRONATUM C.DC. in Smiths. Misc. Coll. 71<sup>6</sup>:12. 1920.

A glabrous shrub, 1–3 m. tall; flowering internodes slender and rather short, pale-granular or glandular-dotted downward; leaves lance-ovate or elliptic, apex attenuately rather long-acuminate, commonly bristle-pointed, base subequilaterally acute, 3–5.5 cm. wide  $\times$  8–12 cm. long, pinnately nerved from below the middle, the nerves 3–4 on each side, with cross-connecting-anastomosing nervules, finely granular- or glandular-dotted beneath, drying green above, paler beneath, rather thin, translucent; petiole 10–15 mm. long, vaginate at the base only; spikes 3 mm. thick  $\times$  4–7 cm. long, apiculate; peduncle 1–2 cm. long; bracts triangular- or lunulate-subpeltate, margin conspicuously white-fringed; fruit globose or ovoid, laterally somewhat compressed; stigmas 3, sessile.

Panama.

CHIRIQUÍ: humid forest around Los Sigüas Camp, southern slope of Cerro de la Horqueta, alt. about 1700 m., *Pittier 3185*; *Maxon 5421*; Bajo Chorro, Boquete District, alt. 1800 m., *Davidson 321*, *719*; forest along the Río Ladrillo and vicinity, about El Boquete, alt. 1200–1300 m., *Maxon 5395*; Monniche Trail, Chiriquí Volcano, alt. 1700 m., *Killip 3523*.

The shape, rather prominent bristle tips, and nervation of the leaves characterize this species.

59. *PIPER SEPTUPLINERVIUM* (Miq.) C.DC. in DC. Prodr. 16<sup>1</sup>:313. 1869.

*Artanthe septuplinervia* Miq. in Seem. Bot. Voy. Herald, 199, pl. 40. 1854.

Shrub (?), glabrous, strongly nodose; flowering internodes short and slender, smooth or somewhat scurfy-granular; leaves lance- or oblong-ovate, apex rather long and sharply acuminate, base equilateral, rounded, obtuse, 3–4.5 cm. wide  $\times$  9–12 cm. long, pinnately nerved below the upper third, the nerves 4–5 on each side, prominent beneath, with fine cross-connecting-anastomosing nervules, drying pale green, firm, narrowly revolute, scarcely glandular-dotted; petiole about 5 mm. long, channelled above, vaginate at the very base only; spikes 4 mm. thick  $\times$  3–4 cm. long when mature; peduncle 5–10 mm. long; bracts round-subpeltate, glabrous in the center, marginally somewhat ciliate; fruit obpyramidal-trigonous, puberulous toward the top, stigmas 3, sessile.

Panama.

PANAMA: without location, *Seemann 1066*. COLÓN: forests around Porto Bello, alt. 5–100 m., *Pittier 2477*.

59a. *PIPER SEPTUPLINERVIUM* var. **subpubinervium** Yuncker, var. nov.

Foliis 4.5–5 cm. latis, 12 cm. longis, luteo-glandulosis, venis supra puberulentis subtus glabratis; bracteis triangulari-subpeltatis, margine luteo-fimbriatis.

Leaves 4.5–5 cm. wide  $\times$  12 cm. long, yellow-glandular-dotted, nerves above puberulent, glabrous beneath; bracts triangular-subpeltate, marginally yellow-fringed.

Known only from the type locality.

PANAMA: without locality, 1859–1860, *Hayes 783* (no 678 also on the bottom of label) (Herb. New York Bot. Gard., TYPE).

The glabrous, strongly nodose twigs, and glabrous, round-based leaves characterize this species which appears to be rather closely related to *P. aequale*.

60. *PIPER SUBQUINQUENERVE* Trel. in Field Mus. Nat. Hist. Bot. Ser. 18:363. 1937.

A shrub (?), nodose, essentially glabrous; flowering internodes slender and short; leaves lance-elliptic, apex acuminate, base subequilateral, acute, 2.5–3 cm. wide  $\times$  8–10 cm. long, pinnately nerved from the lower half, the nerves 3 on each side, long-ascending, connected with the midrib with cross-connecting nervules, commonly with two pair near the base and the third pair arising at about the middle, yellowish and microscopically puberulent glabrescent beneath, drying rather thin and dull, translucent; petiole 5–12 mm. long, grooved above but vaginate only at the very base; spikes as yet young, 2 mm.  $\times$  3.5 cm. long; peduncle about 1.5 cm. long; bracts round-subpeltate, smooth above; ovary and fruit not developed.

Known only from the following locality.

BOCAS DEL TORO: Changuinola Valley, *Dunlap 452*.